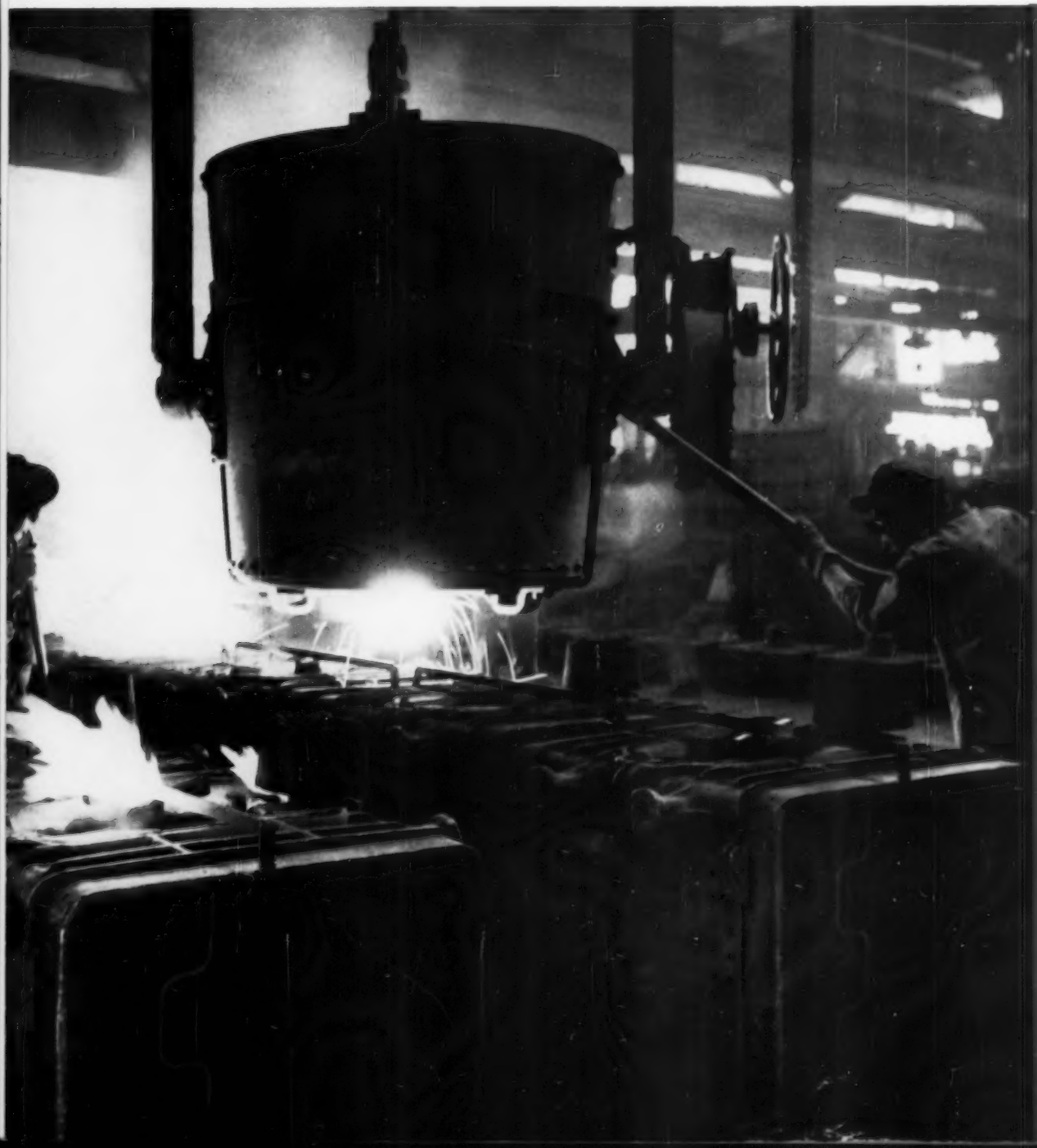
SEPTEMBER, 1955

modern castings

and American Foundryman



Owned by THE MEN WHO BUY

Steel Car Wheels by New Process

Graphite molds plus air pressure pouring solves difficult casting problem

Melting by Radiant Heat

Continuous aluminum furnace conserves fuel, controls melt, cuts overhead

Making Small Risers Work

Insulating and exothermic risering and padding materials can increase quality

Core Room Pitfalls

Supervisors must be taught that cores are not an end but a means to an end

All About Forehearth Refractories

Here are results of a 7-year search for the most suitable refractories

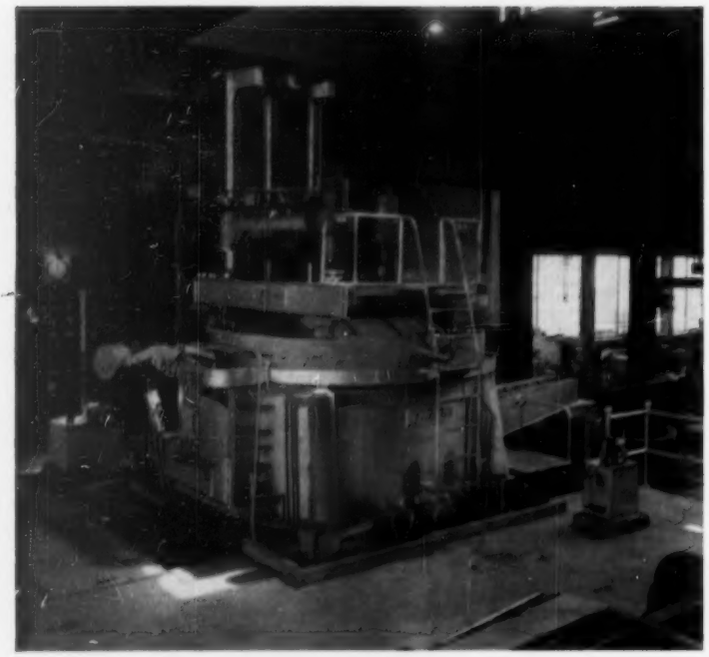
New Test for Metals

Microscope and microbend tester give new tool for studying flow of metals

BONUS SECTION

16-page manual on foundry costs and how to control them

"A Lectromelt Furnace
is a good instrument to work with...



WE GOT ONTO CONTROL ON OUR FIRST TRY, AND KEPT IT ON,"

says **August Rossetti,**
General Superintendent,
McConway & Torley Corp., Pittsburgh

"WE'VE been very, very successful with our Lectromelt* Furnaces—producing both carbon and alloy steels for railroad castings, armor and gun shields, many to rigid radiographic specifications."

Getting on control and holding it there is a familiar story to long-time Lectromelt Furnace users. Foundries are better able to duplicate heat after heat, maintaining top quality because of closer regulation of power and electrodes. The flexibility of Lectromelt Furnaces permits quick shifts in metal production, making it more profitable to go after special casting business.

For a free copy of Catalog No. 9, or for engineering help in adapting an electric arc furnace to your foundry, write Pittsburgh Lectromelt Furnace Corporation, 316 32nd Street, Pittsburgh 30, Pennsylvania.

This 12-ton OT Lectromelt Furnace was installed in 1945.

6-ton PT Lectromelt Furnace installed in 1942.

Manufactured in...GERMANY: Friedrich Kocks GMBH, Dusseldorf...ENGLAND: Birlec, Ltd., Birmingham ...FRANCE: Stein et Roubaix, Paris...BELGIUM: S. A. Belge Stein et Roubaix, Bressoux-Liege...SPAIN: General Electrica Espanola, Bilbao...ITALY: Forni Stein, Genoa. JAPAN: Daido Steel Co., Ltd., Nagoya

*REG. T. M. U. S. PAT. OFF

MOORE RAPID

WHEN YOU MELT... *Lectromelt*

CIRCLE NO. 103, PAGE 81-82

future meetings and exhibits

SEPTEMBER

1-15 . . Engineering, Marine and Welding Exhibition and Foundry Trades Exhibition, *Olympia, London, England.*

6-17 . . National Machine Tool Builders Association, *International Amphitheater, Chicago. Machine Tool Show.*

6-17 . . Coliseum Machinery Show, *Chicago Coliseum, Chicago.*

6-17 . . Production Engineering Show, *Navy Pier, Chicago.*

12-16 . . Industrial Engineering Conference, *Michigan State University, East Lansing, Mich.*

12-16 . . Instrument Society of America, *Shrine Exposition Hall, Los Angeles. 10th Annual Conference and Exhibit.*

20-22 . . Tenth Annual Industrial Packaging & Materials Handling Exposition, *Kingsbridge Armory, New York. Sponsored by Society of Industrial Packaging & Materials Handling Engineers.*

29-30 . . Missouri Valley Regional Conference, *Missouri School of Mines, Rolla. Sponsored by the St. Louis, Mo-Kan and Tri-State Chapters of AFS, in cooperation with Missouri School of Mines.*

OCTOBER

6-7 . . National Foundry Association, *Edgewater Beach Hotel, Chicago. Fifty-seventh Annual Meeting.*

13-15 . . Foundry Equipment Manufacturers Association, *The Greenbrier, White Sulphur Springs, W. Va. Annual Meeting.*

13-15 . . Committee on Vacuum Techniques Inc., *Mellon Institute, Pittsburgh. Symposium on vacuum technology.*

14-15 . . New England Regional Foundry Conference, Massachusetts Institute of Technology, Cambridge. Sponsored by the New England Foundrymen's Association in cooperation with MIT.

14-15 . . Northwest Regional Foundry Conference, *Portland, Ore.*

16-18 . . Conveyor Equipment Manufacturers Association, *The Greenbrier, White Sulphur Springs, W. Va. Annual Meeting.*

17-18 . . American Coke and Coal

Chemicals Institute, *The Greenbrier, White Sulphur Springs, W. Va. Annual Meeting.*

17-21 . . National Safety Congress and Exposition. *Chicago, Ill. Forty-third Annual Congress*

17-21 . . American Society for Metals, *Convention Hall, Philadelphia. National Exposition and Congress.*

18 . . American Society of Safety Engineers, *Conrad Hilton Hotel, Chicago. Annual Meeting.*

19-21 . . Gray Iron Founders' Society, *Hotel Schroeder, Milwaukee. Twenty-seventh Annual Meeting.*

20-21 . . Ohio Regional Foundry Conference, *Case Institute of Technology, Cleveland. Sponsored by the Northeastern Ohio, Toledo, Canton District, Central Ohio, and Cincinnati District Chapters of AFS in cooperation with Case Institute of Technology.*

20-21 . . Sixth Annual National Noise Abatement Symposium, *Armour Research Foundation of Illinois Institute of Technology, Chicago.*

24-25 . . Steel Founders' Society of America, *The Greenbrier, White Sulphur Springs, West Virginia. Fall Meeting.*

24-26 . . Sixth National Conference on Standards, *Sheraton-Park Hotel, Washington, D. C. Sponsored by the National Bureau of Standards and the American Standards Association.*

31-Nov. 1 . . Magnesium Association, *Biltmore Hotel, New York. Annual Meeting.*

NOVEMBER

1-3 . . Grinding Wheel Institute and Abrasive Grain Association, *Statler Hotel, Buffalo. Fall Meeting.*

1-3 . . Investment Casting Institute, *Sheraton-Cadillac Hotel, Detroit. Annual Fall Meeting.*

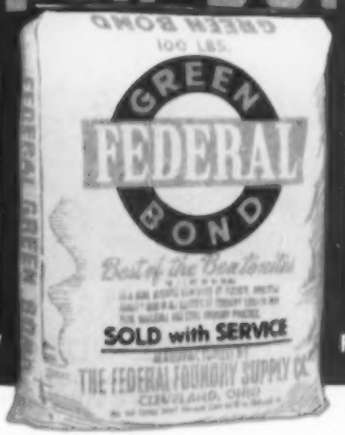
3-4 . . Metals Casting Conference, *Purdue University, West Lafayette, Ind. Sponsored by the Central Indiana and Michiana Chapter of AFS in cooperation with Purdue University.*

13-18 . . American Society of Mechanical Engineers, *Congress, Conrad Hilton, and Sheraton-Blackstone Hotels, Chicago. Diamond Jubilee Annual Meeting.*

14-17 . . International Automation Exposition, *Navy Pier, Chicago.*

16-18 . . Steel Founders' Society, *Hotel Carter, Cleveland. Annual Technical and Operating Conference.*

GREEN BOND
GREEN BOND
GREEN BOND
GREEN BOND



PURE BENTONITE . . . SPECIALLY PREPARED FOR FOUNDRY USE

the standard of the world for 30 years

Bentonite was first developed in 1925, by FEDERAL, as an admix to molding and core sands. FEDERAL GREEN BOND was introduced at that time as a *pure* bentonite of the highest quality, specially processed for foundry use. It's been just that ever since—unadulterated, untreated, free of chemicals or other ingredients detrimental to foundry sands or operating conditions.

FEDERAL GREEN BOND is supplied in *three* convenient forms: (1) PULVERIZED—for general foundry use as a dry additive for core and molding sand; (2) GB-100 FINE GRANULAR—a dry additive with low dust content, for core and molding sand; (3) No. 1200 SLURRY GRADE GRANULAR—for use as a wet additive.

Next time you buy bentonite—buy the "Best of the Bentonites", the old reliable—FEDERAL GREEN BOND!

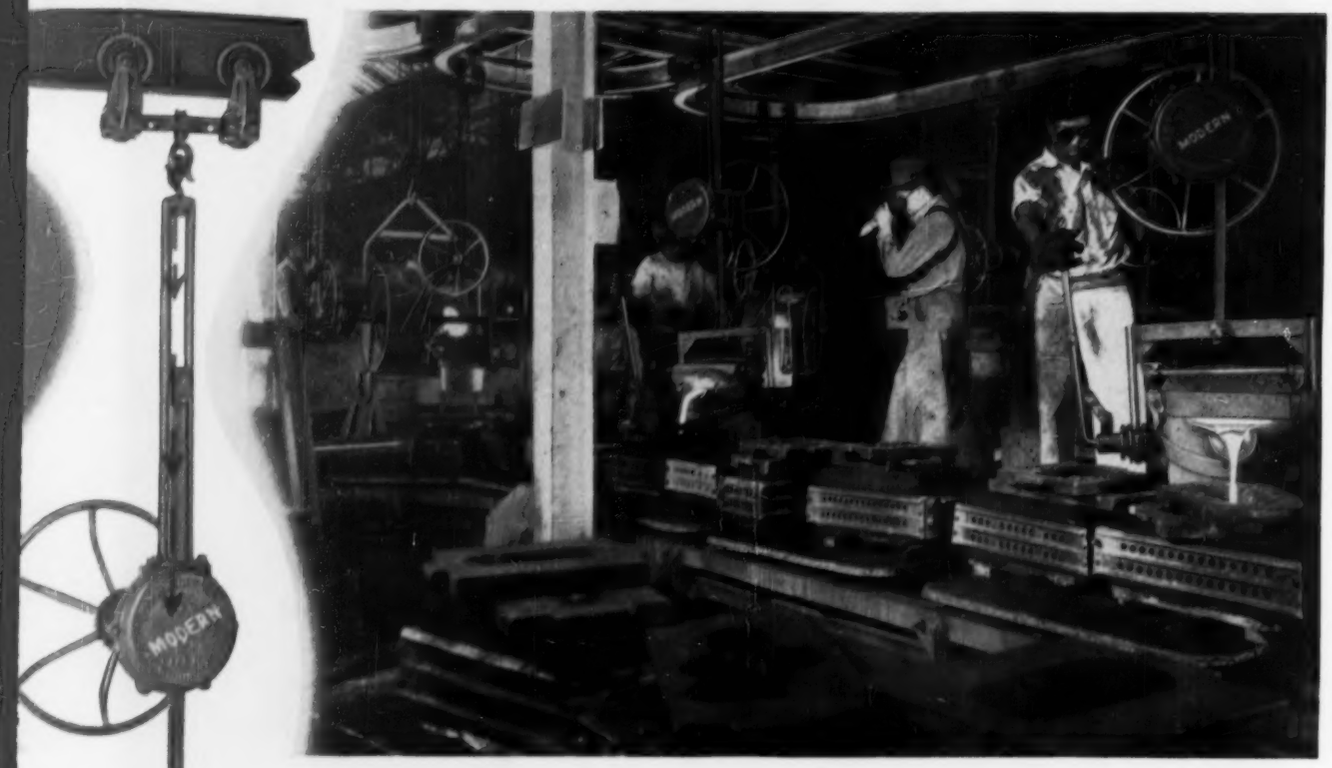
FEDERAL warehouses are located in CHICAGO · CHATTANOOGA · CROWN HILL, WEST VA. · DETROIT · MILWAUKEE · NEW YORK · RICHMOND, VA. · ST. LOUIS · UPTON, WYO. *FEDERAL GREEN BOND is also available in* BIRMINGHAM JACKSONVILLE, FLA. · LOS ANGELES · MINNEAPOLIS · OAKLAND, CALIF. · PORTLAND and SEATTLE, WASH.

FEDERAL

The FEDERAL FOUNDRY SUPPLY *Company*
4600 EAST 71st STREET, CLEVELAND 5, OHIO

CIRCLE NO. 99, PAGE 81-82

A LIFT *for your* POUR-OFF-MEN



Rigid, straight-line control from monorail to ladle spout for quick accurate spotting over the sprues.

WORKING TOGETHER WITH PRACTICAL FOUNDRYMEN...

MODERN engineers developed the Pouring Device. That's how our business began!

Today this MODERN one-man-pouring method, as proved in a quarter century's service to foundries, is highly productive—both for the foundry that sets up a floor or two a day, as well as for the large manufacturer* with his most elaborate, double-loop conveyor system.

The MODERN cylindrical ladles, together with their 2000 pound loads of gray iron, are trucked from the cupolas to the pouring floor. In this MODERN equipped operation up to 70 tons of tractor cylinder liners, heads and manifolds are poured in an 8 hour shift. Several of the ladles and the MODERN "FA" Pouring Devices have been in operation since 1938. Herein is a timely story on the effective distribution of manpower. You can read more about it in catalog 147: It's free to foundrymen who make request on their company letterheads to—Dept. A-9, MODERN EQUIPMENT COMPANY, Port Washington, Wisconsin.

*Allis-Chalmers, Milwaukee

MODERN EQUIPMENT CO.
PORT WASHINGTON, WISCONSIN

OTHER FREE CATALOGS
Ladles and Pouring Systems...P-152-A
Cupolas and Chargers.....No. 147-A
Monorails, Cranes, Switches.No. 150

17-18 . . American Society for Quality Control, *Schroeder Hotel, Milwaukee. Tenth Mid-West Conference.*

18-19 . . New York State-Canada-Pennsylvania Regional Foundry Conference, Onondaga Hotel, Syracuse, N. Y. *Sponsored by Central New York, Eastern Canada, Eastern New York, Rochester, Western New York, Northwestern Pennsylvania and Ontario Chapters of the American Foundrymen's Society.*

DECEMBER

1-2 . . Michigan Regional Foundry Conference, *Michigan State University, East Lansing, Mich. Sponsored by the Detroit, Saginaw Valley, Central Michigan and Western Michigan Chapters of the American Foundrymen's Society and the Michigan State University and University of Michigan Student Chapters.*

7-9 . . American Institute of Mining and Metallurgical Engineers, *Hotel William Penn, Pittsburgh. Electric Furnace Steel Conference.*

1956
FEBRUARY

9-10 . . Wisconsin Regional Foundry Conference, *Schroeder Hotel, Milwaukee. Sponsored by the AFS Wisconsin Chapter and the University of Wisconsin and the AFS Wisconsin Student Chapter.*

16-17 . . Southeastern Regional Foundry Conference, *Tutwiler Hotel, Birmingham, Ala. Sponsored by the Birmingham District and Tennessee Chapters and the University of Alabama Student Chapter of American Foundrymen's Society.*

27-Mar. 2 . . American Society for Testing Materials, *Statler Hotel, Buffalo. 1956 Committee Week.*

MARCH

7-8 . . Foundry Educational Foundation, *Hotel Cleveland, Cleveland. College-Industry Conference.*

15-16 . . Steel Founders' Society of America, *Drake Hotel, Chicago. Annual Meeting.*

MAY

3-9 . . American Foundrymen's Society, *Convention Hall, Atlantic City, N. J. 60th Annual Convention and Exhibit.*

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september 1955
vol. 28 no. 3

modern castings

and American Foundryman

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AUDITED PAID CIRCULATION ABC

TIPS, TRENDS AND TECHNIQUES

Steel valves are poured in vertically-parted molds in the Oakland (Calif.) plant of General Metals Corp. The cover shows a common scene in the company's new $5 million operation.

Chilled freight car wheels have hauled the nation's freight for many years and have been turned out by foundries located all over the country. When speeds and loads increased the abuse wheels had to stand, forgings started to encroach in this traditionally foundry field. How wheel foundries expect to hold their own is told in the story of graphite molds and pressure pouring of steel wheels (pages 26-29).

Concentrating the heat where it will do the most good pays off in the new continuous furnace (pages 30-31) used in a permanent mold foundry for efficient, composition-controlled melting.

Like skinning a cat, there are several ways to do it. You can keep risers liquid longer and improve casting soundness with insulating materials of various kinds. Or you can add heat to the riser by means of exothermic mixtures. A non-ferrous shop tried several ways and reports its success in higher yields and lower scrap on pages 32-35.

Core room problems can be minimized through purchase of raw materials from dependable sources of supply. Another major move toward fewer core room pitfalls is sound supervision (pages 36-37).

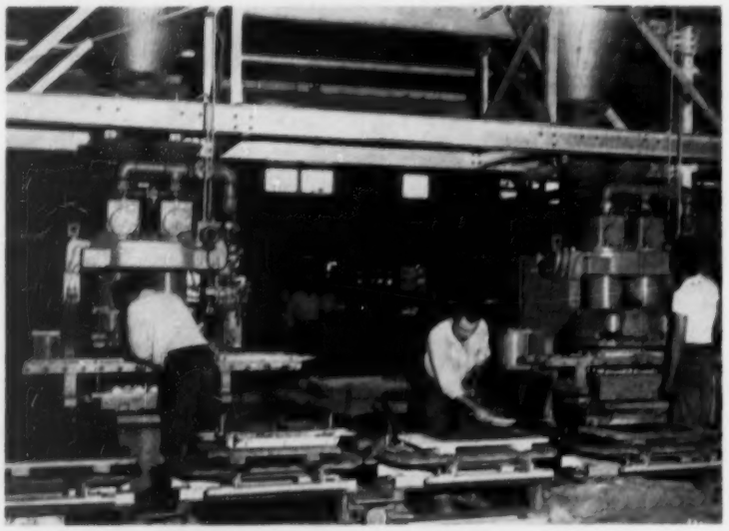
Flexible budgets substitute facts for guesses. See this month's Bonus Section, a how-to-do-it accounting manual for modern foundry managers (pages 39-54).

Refractories don't always take to soda ash slags like a duck takes to water. How a number of bricks, cements, and monolithic materials behaved in desulphurizing ladles over a 7-year period is detailed on pages 56-60.

Metallurgical post-mortems aren't nearly a useful as a test that shows what goes on while the metal is actually stressed. Vest pocket test is covered on pages 62-65.

Shell mold trouble shooting, operating hints and shell core blowing combine to make the October Bonus Section a handbook of useful information for all shell molding operators. Rest of next month's issue keeps up **Modern Castings'** standards in the field of casting in cores . . . sand handling . . . suggestion systems . . . investment casting.

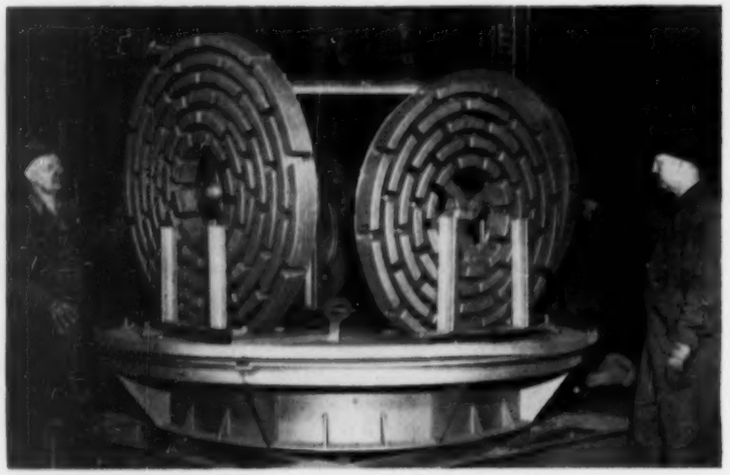
Now They're Blowing Fitting Molds



Here's How Wilmington Castings Co., Wilmington, Ohio, increased casting quality on 2-in. pipe fittings. This first application of mold blowing to fitting production incorporates Beardsley & Piper Moldblomatic machines with a complete molding unit including, sand preparation, pouring, cooling, shakeout, and sorting.

CIRCLE NO. 1, PAGE 81-82

Airless Blast Slashes Cleaning Time



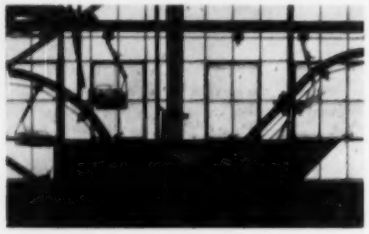
Here's How Love Brothers, Inc., Aurora, Ill., jobbing foundry, cut 68% from cleaning time on these 975-lb, 4 ft diam gray iron runner bars for glass grinding machines, while doing a better job. American Wheelabrator airless abrasive blast cleaning cut cleaning costs 36% for this casting alone, saving $7310 a year.

CIRCLE NO. 2, PAGE 81-82

products and processes

Overhead Conveyor

New type overhead monorail conveyor has been developed which is ideal for use in foundries and other shops where there is a problem of dust and abrasives causing excessive wear on conventional type conveyors. The use of segments of cable between the trolley brackets has eliminated all moving parts below the monorail, thus eliminating points of wear and simplifying the maintenance of equipment. Flex-I-Line uses a unique trolley bracket cast



in one piece of malleable iron or high tensile aluminum. A simple locking device, known as a Flex-Lock, holds the swaged end of the cable segments securely in place yet permits the cable to rotate in the bracket, reducing torsional forces on the cable. The use of cable as connectors between the trolley brackets leads to great flexibility and permits sharper dips to be made. This feature results in savings of space through the use of smaller auxiliary equipment and the utilization of small areas not heretofore adaptable to conveyorizing. *Flex-I-Line Conveyor Corp.*

CIRCLE NO. 3, PAGE 81-82

Masonry Saw

New Target Thrifty is claimed to be the first full-size, full capacity masonry saw in the low price field. Only the head height adjusting mechanism has been omitted. The 1½ hp totally enclosed motor, cutting head, saw frame and conveyor cart are of the same full size as on the Target Roll-O-Matic. A dual voltage switch to convert the motor instantly from 110 to 220 volts is standard equipment. Angle-set mechanism permits operator to instantly angle the cutting head from any size material, for any kind of cut. Cutting head is removable in two seconds for instant portability. *Robert G. Evans Co.*

CIRCLE NO. 4, PAGE 81-82

Rugged Tractor Shovel

Speedall tractor shovels are available in 1¼, 1¾, and 2½ cu yd capacities. Powered by gasoline or diesel engine, have power steering and four-wheel brakes. Clutch pedal has been elimi-

nated; two simple levers on steering column hydraulically shift four speeds forward, four speeds reverse. Accessories available include snow bucket, lift for crane hook, V and one-way snow plow, and bulldozer blade. *Pettibone Mulliken Corp.*

CIRCLE NO. 5, PAGE 81-82

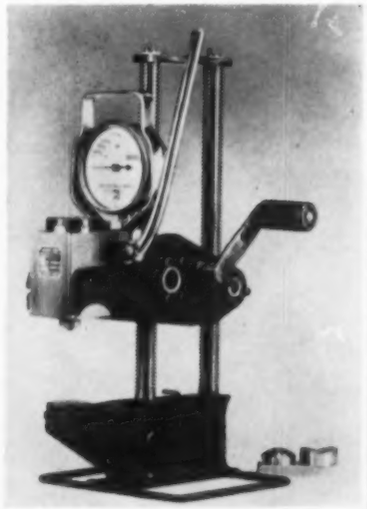
High-Deposition Electrode

Mir-O-Col 3S, a general, all-purpose electrode, producing a tough, abrasive- and shock-resistant weld, is recommended for rebuilding heavy equipment such as bulldozer blades and bucket teeth. Deposition of at least one-third more than conventional-type rods, using a stringer or weaving bead, vertical or downhand saves considerable time and labor. May be used with either AC or DC current, with straight polarity recommended. Free samples of electrode, and descriptive literature available on request. *Mir-O-Col Alloy Co., Inc.*

CIRCLE NO. 6, PAGE 81-82

Portable Hardness Tester

Portable Brinell hardness tester makes accurate tests on ferrous metals of any shape or size at the bench or almost anywhere in or out of the plant. Elim-



inates test bars, making only one, easily-read impression. Can be used near vibration without affecting accuracy. Narrow and shallow nose at the anvil and the recessed base permit testing in small, cramped spaces, tubes, and cylinders. *Andrew King.*

CIRCLE NO. 7, PAGE 81-82

Sand Moisture Recorder

Moist Recorder is a new, continuous foundry sand moisture tester and recorder that measures and records the moisture content of sand in a bin, hopper, or traveling on a conveyor. Compact, self-contained, it consists of a

high–frequency capacitance bridge, moisture probe, and either a circular or strip chart recorder. Two lights indicate when sand is running above or below desired moisture content. Audible alarms can be furnished to signal out-of-range moisture. *Harry W. Dietert Co.*

CIRCLE NO. 8, PAGE 81-82

CIRCLE NO. 87, PAGE 81-82

MONSANTO PROFIT PICTURES

You get stronger shell molds... higher density... with **Resinox 736**

Traditional finishing costs are being converted to profits with Resinox 736 at Murphy Shell Mold and Casting Co., Morral, Ohio

MONSANTO'S PHENOLIC RESIN PRODUCES CASTINGS WITH SMOOTHER, FINER FINISH

Strong, dense molds are the secret of quality castings. It means you can concentrate more sand in each square inch, which results in a smooth, almost flawless surface in the finished piece.

Resinox 736 will give you this advantage. It has been specifically developed for precision casting work. This means elimination of blisters, scabs and sand crust which have to be machined or ground away when other methods or materials are used.

At the Murphy Shell Mold and Casting Co., where Resinox 736 is used exclusively as a shell binder, this advantage has amounted to "a 20% gain in production and an 80% reduction in cleaning costs."

If excessive machining and finishing requirements are hurting your profit picture, try shell molds bonded with Resinox 736 phenolic resin.

For a complete line of shell molding, core binding and sand conditioning resins that are research-developed and shop-tested to meet your foundry needs, write first to Monsanto Chemical Company, Plastics Division, Dept. AF-9, Springfield 2, Mass.

For stronger shell molds, specify

RESINOX® MONSANTO

Long Bronze Welding Rods

Flux-coated, low-fuming bronze welding rods are now available in 36-in. lengths. Applied at 1650 F, develops tensile strength of 60,000 psi. *All-State Welding Alloys Co., Inc.*

CIRCLE NO. 9, PAGE 81-82

Non-Ferrous Riser Saver

Thermogard is a new, improved material for riser insulating sleeves and pads for brass, aluminum, and magnesium castings. Reduces risers as much as 75 per cent, gives better directional solidification. Available in pads and sleeves of standard or custom shapes. Mechanically strong, fully protected from moisture, will not contaminate sand. *Exomet, Inc.*

CIRCLE NO. 10, PAGE 81-82

Scrap Metal Baler

Balemaster is a light weight, hydraulic, portable scrap metal baler that compresses light gauge metals into 12-in. cubes. Requires no pit; will bale material up to 54 in. long. Dimensions: 12 ft 3 in. long; 41 in. wide, 67 in. high. Weight is 4000 lb. *Balemaster Div., East Chicago Machine Tool Corp.*

CIRCLE NO. 11, PAGE 81-82

Controlled Atmosphere Furnace

Forced convection heat treating unit is semi-automatic controlled atmosphere furnace with bottom charging design. Furnace and quench chambers never open to room atmosphere during operation. Gas-fired, push-button controlled, pneumatic powered. *Denver Fire Clay Co.*

CIRCLE NO. 12, PAGE 81-82

Sandblast Nozzles

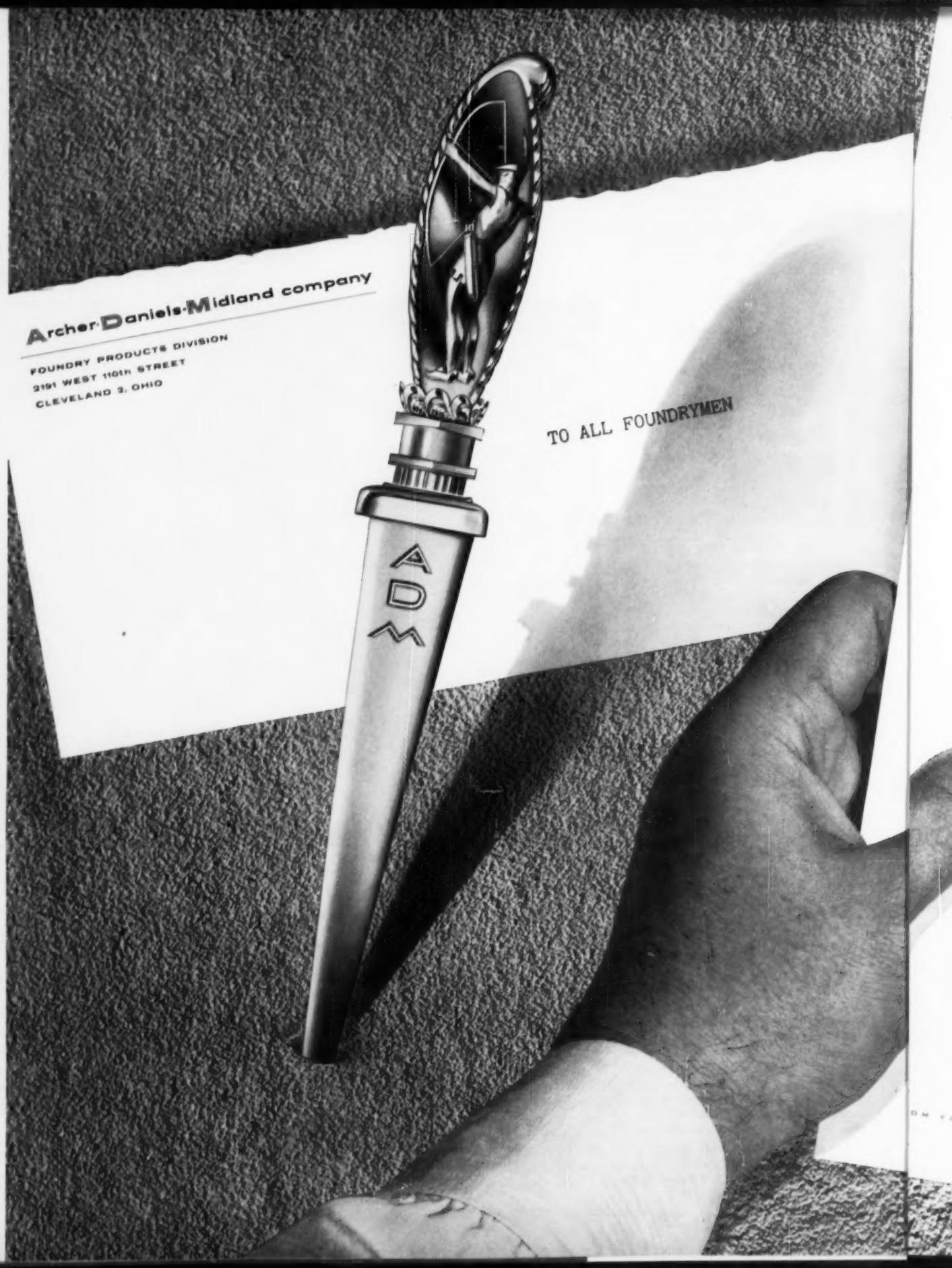
Clemco Venture Nozzles will fit all sandblast machines, have cut operating costs 20 to 40 per cent. Design produces higher impact, larger pattern without fringe areas, does more work with same amount of abrasive and air. Tungsten carbide lining. *Clementine Ltd.*

CIRCLE NO. 13, PAGE 81-82

Coupling Link

Hammerlok is a coupling link that enables chain users to make their own slings and special assemblies. Consisting of a pair of body halves, a tubular stud, and a hardened alloy steel pin, Hammerlok can be assem-

CIRCLE NO. 89, PAGE 81-82



Archer-Daniels-Midland company

FOUNDRY PRODUCTS DIVISION • 2191 WEST 110TH STREET

CLEVELAND 2, OHIO

OPEN LETTER TO ALL FOUNDRYMEN:

The next step to making better, more uniform, lower-cost cores is yours. ADM can help you. Here's how:

1) ADM makes all types of binders: urea and phenol synthetic resins, alkyds, D process and C process binders, numerous specific-purpose LINOILS and several fast-baking INDUCTOLS. Therefore, we can impartially prescribe the type that is right for your specific application.

2) ADM core binders can often cut your core oil costs 10c to 40c per gallon due to our completely integrated production.

3) With 26 ADM warehouses and manufacturing facilities in 6 locations, you get overnight delivery anywhere in the country.

4) ADM's field organization (the largest in the business) is always at your service.

If you want to make a good casting better...if you are especially concerned about quality or uniformity of cores, see your ADM LINOIL man. Call him today.

Sincerely,

ARCHER-DANIELS-MIDLAND COMPANY
Foundry Products Division

L. P. Robinson
Vice President

ADM FOUNDRY PRODUCTS: LINOIL CORE OILS • INDUCTOL FAST BAKING CORE OILS • LIN-O-CEL SAND STABILIZER • FREFLO PARTING COMPOUND • ADMIREZ FOUNDRY RESIN

LINOIL THE LOGICAL OIL

bled in seconds. No peening or welding; link can be disassembled and re-used. *Columbus McKinnon Chain Corp.*

CIRCLE No. 14, PAGE 81-82

Combustion Safeguard

Design of the new 1400 Series Wheelco Flame-otrol has been based on the flame rectification principle while the 1500 Series makes use of a lead sulphide photo-conductive cell responsive to infra-red as a detection element. All models of the new series are housed in a smartly designed and attractive cabinet. They also incorporate a plug-in type chassis. Other outstanding features include a safety-type terminal strip, convenient checking strips, the use of standard electronic tubes and heavy duty construction throughout. *Barber-Coleman Co.*

CIRCLE No. 15, PAGE 81-82

Thermistor Compensated Pyrometers

Three sizes of sealed, rugged instruments have been added to the line of pyrometers made by *Assembly Products, Inc.*, bringing to ten the number of case styles to choose from. All have automatic bimetal cold junction compensation and thermistors for high accuracy over wide variations of ambient temperature. Seventeen temperature ranges are listed from 400 F to 3000 F; corresponding Centigrade is shown on each dial. Sensitivity is 4 ohms per millivolt. Bulletin G-9 available.

CIRCLE No. 16 PAGE 81-82

Temperature-Sensitive Paint

At 400 F Temp-Alarm GA-I temperature-sensitive paint changes from mustard yellow to maroon in five minutes. No permanent color change takes place below 375 F. Brushed or sprayed on the outside of forehearths and mixers and allowed to dry, this paint indicates where the lining has worn excessively. Free samples and leaflet with directions for application on request. *Tempil® Corp.*

CIRCLE No. 17, PAGE 81-82

Automatic Arc-Controlled Welder

Controlarc, new magnetic amplifier-rectifier DC welder is said to provide full time automatic arc control under all conditions from arc strike to end of pass. Assures easy, clean arc strikes, hot starts and immediate penetration, uniform fusion and steady rate of metal deposit, prevention of arc "pop outs" and current drop-off. Other features include downdraft cooling, separate, duct-cooled reactor and transformer units, conservatively rated re-

MORE WORK . . . FASTER!
WITH ERIE STRAYER HOOK-ON CLAMSHELLS

CHECK these exclusive features:

- √ EASY HOOK-ON—no changeover problem. Versatile.
- √ COMPACT, RUGGED DESIGN—longer, tougher service.
- √ LIMITED HEADROOM REQUIREMENT—made for tight spots.
- √ ALWAYS UNDER PERFECT CONTROL—eliminates shock.
- √ ¼ TO 10 YARD CAPACITY—models to suit your needs.

THE FAMOUS **STRAYER ELECTRIC** BUCKET
ALSO AVAILABLE FOR AC OR DC OPERATION

For Catalogs and General Information, Write:

ERIE STRAYER CO.
GEIST ROAD • ERIE, PENNSYLVANIA

CIRCLE NO. 114, PAGE 81-82

tifiers for long life, and sealed-in lubrication of fan motor bearings. *Vickers Electric Div., Vickers Inc.*

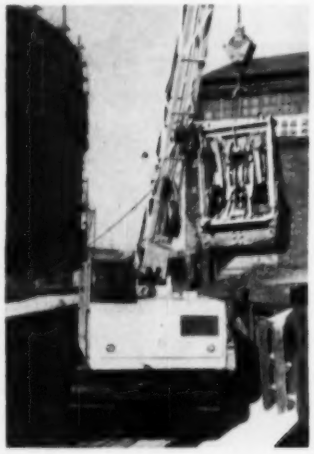
CIRCLE NO. 18, PAGE 81-82

Rotary Carbide Cutting Tools

Carbo-Mills, for removing gates, fins, and risers, breaking sharp corners and edges, machining carbon, finishing castings of any material, working fillets, radii, and grooves, and smoothing weld beads, are now available in a 3/16 in. diam. shank series. In addition, five new sizes and one new shape round out the ¼-in. shank series. Ideal for use on abrasive or tough parts having hardnesses up to 60 Rockwell C, they are useful in maintenance and in production of dies, molds, and metal patterns. Bulletin CM available. *Severance Tool Industries, Inc.*

CIRCLE NO. 19, PAGE 81-82

Crane Works Tight Spots

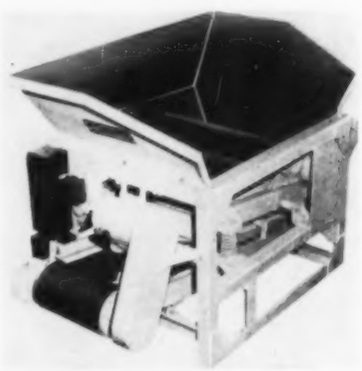


Here's How Ferguson & Lange Foundries Inc., Chicago, uses a Coles Crane to save demurrage costs. Full 360° swing of the cantilever-type boom on "A" frame top-center, got closer to the work, allowed efficient rearrangement of the yard, and relieved several men from yard work. The crane is also equipped for magnet operations. Hoist, boom hoist, slew, and travel motions are powered by individual DC motors on current from a gas-electric generator, may be operated at same time or separately.

CIRCLE NO. 20 PAGE 81-82

Sand Conditioner

New "80" Preparator has sand capacity of 78 tons per hour, requires no pit. Can be used with any front-end loader; loading height is only 50 in. Hopper capacity of 65 cu ft may be increased where headroom is available. Belt and screen drive have sep-



arate dust-proof motors. New high capacity electromagnetic separator provides complete scrap removal; new design lump breaker is more efficient. Readily adaptable to Speedmuller-Preparator installations. *Beardsley & Piper Div., Pettibone Mulliken Corp.*

CIRCLE NO. 21, PAGE 81-82

RR Car Mover

HemcO-Motive is a roadable rail car switcher and spotter. Bulletin indicates draw bar pull is sufficient to propel three fully loaded cars. Gets

traction through weight transfer of RR cars. Coupler gives positive connection with car; can couple to either side. Fluid drive eliminates tricky coordination usually needed to start heavy loads. *HemcO Mfg., Inc.*

CIRCLE NO. 22, PAGE 81-82

Low-Hydrogen Electrode

Easyarc LH 7-16 electrode deposits over 60 per cent more metal than con-

ventional low hydrogen electrodes. Three factors claimed to make this welding speed possible are: concentrated arc energy, powdered iron coating melts and becomes part of the weld, and extra-heavy coating helps control arc action and allows higher currents to be used with complete safety. For more information about the LH 7-16 and Airco's complete electrode line request "Pocket Guide to Electrodes." *Air Reduction Sales Co.*

CIRCLE NO. 23, PAGE 81-82

Elevator-Dumper

Meltevator, a newly developed automatic elevating and dumping mechanism, can be adapted to any process requiring top loading of bins, fur-

naces, or other receptacles. Lifts and dumps up to 800 lb. Installation space 30 x 30 in.; vertical lift 4 ft. special units made to user's specifications. *Nolan Corp.*

CIRCLE NO. 24, PAGE 81-82

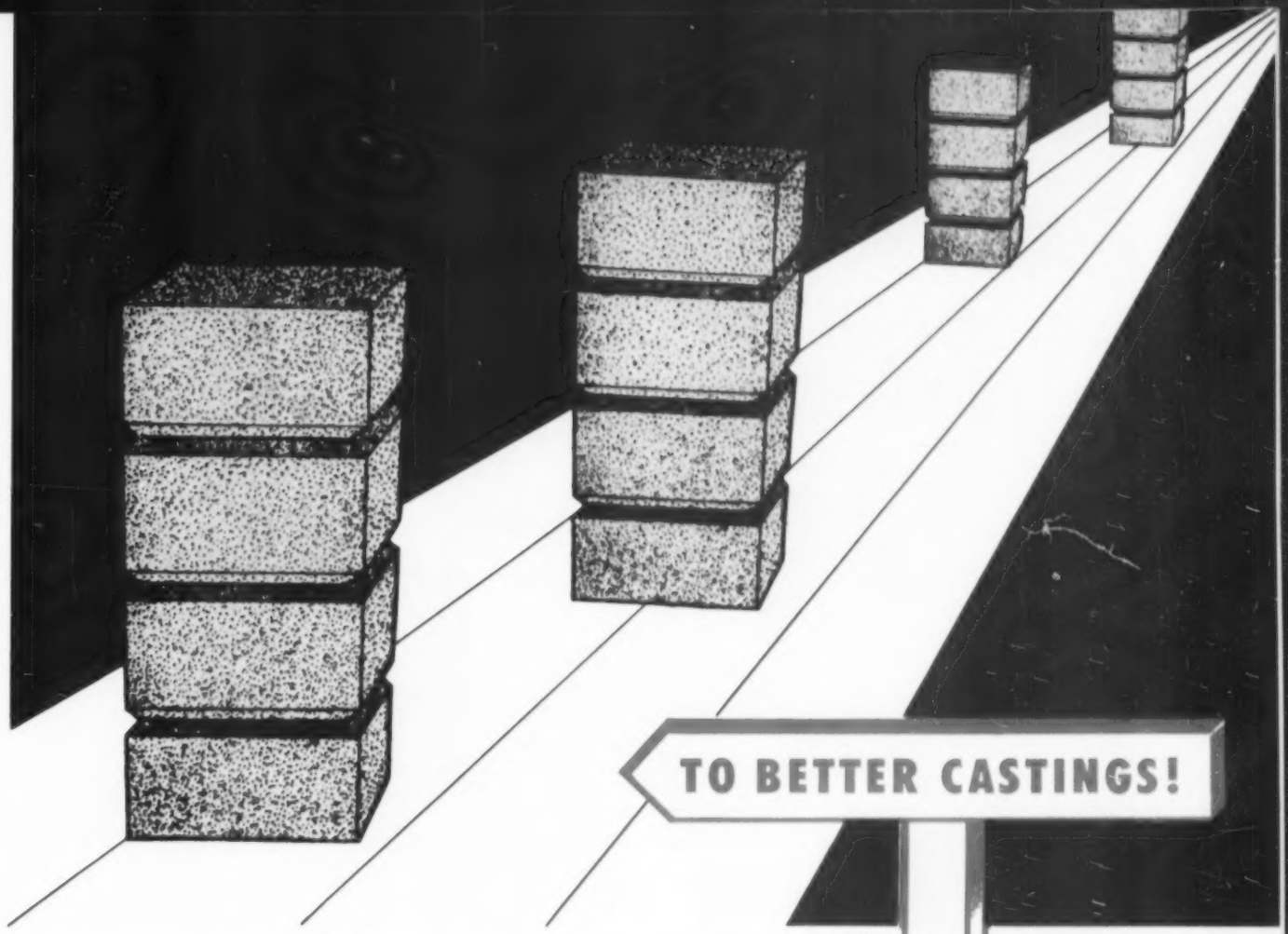
Safety Glasses

Interchangeable lenses, snapped into place without tools, permit the smartly styled frame of new Executive Safety Spectacles to serve more than one purpose. Clear lenses protect eyes from impact; light green lenses from average glare; medium green from extreme

glare. All lenses are curved and oversize for extra protection. *Watchemoket Optical Co., Inc.*

CIRCLE NO. 25, PAGE 81-82

CIRCLE NO. 90, PAGE 81-82



Take the *Famous* CORNELL FLUX Road

A little Famous Cornell Cupola Flux, added to each cupola charge of iron, purges molten iron of impurities so that you pour clean metal every time. Furthermore, the iron is hotter and more fluid, and sulphur is greatly reduced. Many dollars are saved in cupola maintenance, too. Digging out is greatly reduced as drops are cleaner and bridging over is practically eliminated. There is less erosion of cupola lining as a glazed or vitrified protective surface is formed on brick or stone.

Isn't it time to investigate? Hundreds of leading gray iron foundries and malleable foundries with cupolas are now regular users of Famous Cornell Flux.

Famous Cornell Cupola Flux is not only the best flux for cleansing iron, but its form makes it the easiest to use. You use one brick to each ton charge of iron, depending on materials used. For smaller charges, you simply break off one to three sections as per instructions. Write for Bulletin 46-B.

Famous CORNELL
Aluminum and Brass Flux

Makes metal pure and clean.

Permits use of more scrap without danger of dirt, porous places or spongy spots, due to dirty metal.

Thinner, yet stronger sections can be poured

Metal does not cling to the dross as readily.

Crucible or furnace linings are kept clean and preserved.

Cleanses molten brass even when the dirtiest brass turnings or sweepings are used.

Saves considerable tin and other metals.

Forms a perfect covering over the metal during melting, prevents oxidation and reduces obnoxious gases to a great extent.

Write for Bulletin 46-A

The CLEVELAND FLUX Company

1026-40 MAIN AVENUE, N.W. • CLEVELAND 13, OHIO

Manufacturers of Iron, Semi-Steel, Malleable, Brass, Bronze, Aluminum and Ladle Fluxes—Since 1918

FAMOUS CORNELL FLUXES

Trade Mark Registered

Increase RISER EFFICIENCY!

Specify THERMOGARD *Insulating* SLEEVES!

- Increased Feeding Efficiency
- Improved Directional Solidification
- Denser Castings
- Increased Yield
- Economy in Melting and Cleaning

THERMOGARD INSULATING SLEEVES have proved themselves to the copper and aluminum base foundryman as a fool-proof method of producing sounder, denser castings.

THERMOGARD INSULATING SLEEVES are highly insulative, permeable, strong, non-contaminating, and are readily applied. Due to their superior insulating properties, riser diameters may be reduced as much as 70%. Depending upon metal sections and alloys, insulated risers will remain in their liquid phase from three to five times longer than regular sand risers.

The above information holds true for PERLITE and IRON INSULATING SLEEVES, also for EXOTHERMIC SLEEVES.

RISOTHERM
LADLETHERM
INGOTHERM
THERMOGARD SLEEVES
EXOMOLD
BRONZE HOT TOP
CARBON FREE HOT TOP
SUPER TOP
ALUMINUM EXO-GAS
CUSTOM ALLOYS
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Company Name_____

Exothermic Metallurgical Products

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CIRCLE NO. 113, PAGE 81-82

Noise Control Curtain

Bemis TransWall Curtain reduced chipping noise from 104 to 89 decibels in foundry cleaning room. Readings were taken 6 ft from chipping

chisel. Results with curtain indicate that over 95 per cent of the plant area "contaminated" by high level noise can be recovered for useful occupancy. *Bemis Bro. Bag Co.*

CIRCLE NO. 26, PAGE 81-82

Motorized Transfer Car

Cross-Bay, a motor driven transfer car, operates across the bays in parallel bay plants served by overhead cranes. It permits spotting of loads anywhere on the floor of the plant. Also used for transfer between plant buildings, storage yards, or shipping platforms. Cus-

tom designed to meet individual requirements, power drive includes electric motor, storage battery, gas-electric, and gas hydraulic. Control may be manual, electric, electronic, or push button from the car or a remote station. Capacities range from 5 to 500 tons. *Easton Car & Construction Co.*

CIRCLE NO. 27, PAGE 81-82

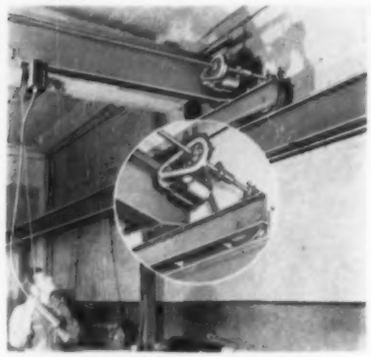
pH Meter Adapter

Swing-Arm Adapter has been designed to make measurements on small liquid volumes safe and convenient by positioning the fragile electrodes in tiny beakers. A simple tilting action immerses the electrodes in exactly the same position each time. Intended for all Photovolt pH meters and primarily to hold their own electrodes, the adapter will take a number of electrodes of other popular makes. Descriptive circular No. 120 is available. *Photovolt Corp.*

CIRCLE NO. 28, PAGE 81-82

Crane Bridge Drive

Travelator provides electric operation of crane bridge, eliminating chain pull. Has single speed push button control for floor operation. Easily installed in short time; unne-



cessary to remove or replace any part of present bridge to install. Adaptable to traveling hand-operated trolleys and hoists, operating transfer cars, door openers. *Northern Engineering Works.*

CIRCLE NO. 29, PAGE 81-82

Redesign Tractor Shovel

Model TL-10 Tracto-Loader has a new bucket with a full cubic yard capacity. Increased bucket width allows operation flush against walls and into corners. This and the machine's 11-ft turning radius make it ideally suited for

most loading operations indoors and out. The bucket has a 25° tip-back that results in low carrying position, bigger loads, faster loading, better operator vision, increased ability to carry heaped loads without spillage, and better overall stability and balance. *Tractomotive Corp.*

CIRCLE NO. 30, PAGE 81-82

Tractor Shovel

15-cu ft capacity 12B Michigan tractor shovel handles maximum loads in and out of boxcars and along narrow aisles. Low center of gravity gives good stability; has short turning radius; protected against dust by sealing

and by filtering torque converter oil, power shift transmission oil, engine lube oil. Powered by 36 hp gasoline engine or 42 hp diesel engine. *Construction Machinery Div., Clark Equipment Co.*

CIRCLE NO. 31 PAGE 81-82

Crack Depth Measurer

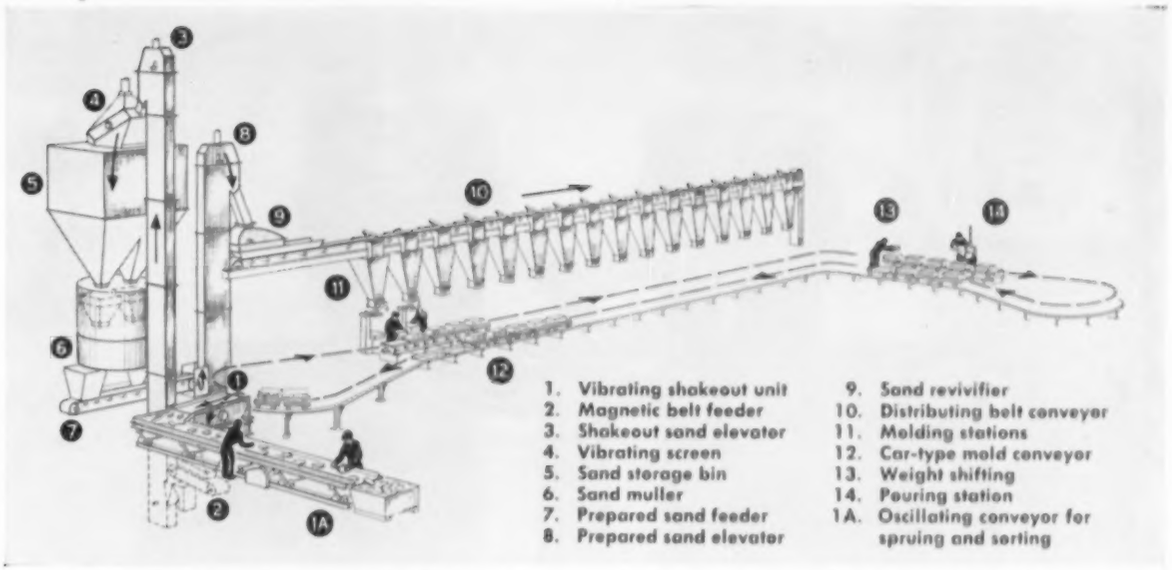
Sedac SE-100 is a portable electronic instrument which nondestructively both detects and measures the depth of cracks in iron and steel. The sensing element is a scanning probe on a 10 ft cable. Relatively symmetrical parts can be scanned automatically. In other cases hand scanning is more practical. The SE-100 will locate and measure

the depth of defects from 0.012 to 0.120 of an inch deep. Larger cracks are detected but their size over 0.120 in. is not measured. By comparison with the known sample provided, the unit can be calibrated to find only cracks deeper than a pre-selected allowable minimum. It can be used on flat pieces and curved surfaces with a 3½ in. or larger radius. The Sedac is equipped with circuits for completely automatic operation. *Magnaflux Corp.*

CIRCLE NO. 32 PAGE 81-82

Handy Pocket Magnifier

Magnify curved, round, or straight-line subjects 5 times with the Precision-



In this modern foundry layout, movement of sand and castings is completely mechanized. With Link-Belt conveying and preparation equipment, gray iron, steel, malleable and non-ferrous foundries can have lower costs, increased output.

Link-Belt automatic shakeout steps up production, removes workmen from hazardous areas, frees them for other jobs.

Conditioned sand is quickly, conveniently distributed to molders' hoppers by flat roll belt conveyor with adjustable plows.

Ideal for handling hot sand and castings, Oscillating conveyors speed cooling, spruing and sorting of castings while en route.

Link-Belt mechanization not only makes large and small foundries a better place to work - - it

raises production-lowers unit costs

TODAY, large and small foundries alike find modernization the only answer to intensified competition. To bring down their costs and make the most efficient use of manpower, they have conveyorized sand and casting handling to a degree undreamed of even a few years ago.

Many of these progressive foundries are completely equipped with Link-Belt conveying and preparation equipment. And just as others have been able to produce better castings at lower cost, Link-Belt mechanization can step up your profits, too. That applies whether your foundry is gray iron, steel, malleable or non-ferrous. Whatever you require in equipment or engineering services, Link-Belt can cut your operating costs . . . and at the same time make your foundry a better place in which to work.

Whenever you have a castings or sand handling or preparation problem, you'll find it pays to call your nearby Link-Belt office. Ask for Book 2423. It shows Link-Belt's complete line of modern equipment for ferrous and non-ferrous foundries plus 7 tested layouts.

LINK-BELT

CONVEYORS AND PREPARATION MACHINERY

LINK-BELT COMPANY: Executive Offices, 307 N. Michigan Ave., Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World.

CIRCLE NO. 91 PAGE 81-82

well worth looking into

Here are some facts well worth looking into to make sure you choose the right core oil for making your casting. First, Penolyn Core Oil assures you maximum foundry efficiency. Second, there is a grade of Penolyn Core Oil to meet the most exacting requirements of every Foundry and Core Room practice. Third, and most important —

If you require expert technical assistance or technical data regarding your present or future casting operations, just call the Penola Office nearest you.

Penola

specify PENOLYN CORE OIL

for these 10 important casting advantages:

1. Dependable uniformity
2. Concentrated form
3. No obnoxious odor
4. Seepage eliminated
5. No crusting, green mix
6. Always clean working
7. Wide temperature range
8. Polymerized formulation
9. Minimum gas
10. Ample collapsibility

PENOLA OIL COMPANY • NEW YORK • CHICAGO • DETROIT

CIRCLE NO. 97, PAGE 81-82

Vision 5-Power Magnifier. High ac racy, non-distortion, and all-arou utility are built in for rough us with 2 in. in diam. aluminum fra ¾ in. thick, with a black crinkle fi to eliminate reflections. Two grou and polished, 1-7/8 in. lenses, pr locked to keep them dustproof break-resistant. Descriptive literat on request. *S. B. Logan Co.*

CIRCLE NO. 33, PAGE 81-82

Air Line Lubricator

Type S air line lubricator empl separable venturi block to get i tight quarters. Block can be roug into an intricate, compact circuit any common pipe fitting; head-b assembly is screwed into it by ha A sintered bronze lubricator wick

jects into block chamber, govern the oil feed rate by the amount of p jection. This lubricator offers pla wide standardization, as one head b fits all sizes of venturi blocks. Si are from ¼ in. NPTF, rated at cfm, to ¾ in. with a 120 rating. *M ter Pneumatic, Inc.*

CIRCLE NO. 34, PAGE 81-82

Laboratory Balance

Model LA-3 laboratory balance capacity of 200 gm and sensitivity 0.02 gm. New Elgiloy torsion ba give longer, trouble-free life. damper reduces oscillation, speeds weighing. Single beam with vern permits accurate weights from 0. gm to 10 gm without use of lo weights. *Torsion Balance Co.*

CIRCLE NO. 35, PAGE 81-82

Core Box Vibrator

VG 2 Cleveland Core Box Vibra is portable, attaches to any size c box, gives clean draw and accur cores. Weighs only 18 lbs; vibrat force is variable for cores of differ size. Eliminates use of hammer, sa time, avoids core box damage. *Cle land Vibrator Co.*

CIRCLE NO. 36, PAGE 81-82

talk of the industry

LIGHT ALLOY CAST BODY of Italian motor scooter combines fuel tank, steering column and light in front, widens out to form fender in rear. Cast integral design reduces dead weight, minimizes components, simplifies assembly.

RUMOR HAS IT that a sand additive used in diaphragm molding is being used to give a small amount of green strength to CO_2-water glass bonded cores.

UNDERPRICED CAST IRON soil pipe imports and unfair competitive practices abroad are behind the Cast Iron Soil Pipe Institute's plea for higher tariff. Foreign labor cost of only one-third that in the United States and low-cost water transportation to U.S. Markets are cited by the institute. Especially hard hit is the Pacific Coast.

WHAT GOES ON when small quantities of air pollutants and the atmosphere react under the influence of sunlight is being studied with an infrared absorption cell developed by the Franklin Institute Laboratories of Philadelphia. Pollutants in concentrations as low as one or two parts per million and reaction products of 1/10 part per million are measured by their characteristic absorption spectra.

GILSONITE, unique hydrocarbon mineral noted for its lack of impurities, has been used by some foundrymen as a seacoal substitute. Next possible foundry use is as metallurgical coke which along with high test gasoline is to be manufactured from Utah deposits by American Gilsonite Co., Salt Lake City.

YEARBOOK of the Foundry Educational Foundation, 1138 Terminal Tower Bldg., Cleveland 13, Ohio, is a progress report telling what FEF means to the castings market and the industry. Advances since the founding of FEF in 1947 are outlined. Also included: desirable foundry courses, supplementary courses considered desirable for a foundry career, funds and scholarships, list of officers and trustees, list of past officers and trustees, and membership directory.

WAGE SURVEY dated June 1 has been issued by the Non-Ferrous Founders' Society. Shown are maximum and minimum wages for molders (machine, bench, floor), coremakers, labor, melters, chippers, grinders, and sandblast operators in 32 areas.

FINGERPRINT OF IMPACT—dynamic stress-strain relationships—on metal is being determined at the Engineering College, New York University, by means of a 14-ft steel tube of 18-in. ID. Impact against a circular specimen is applied by a carefully controlled simulated explosion. High speed, multichannel oscilloscope which can be observed and photographed registers outputs of pressure and deflection transducers and electric strain gauges.

PROBATIONARY EMPLOYEE rating sheet recently distributed by National Foundry Association, 53 West Jackson Blvd., Chicago 4, Ill.,

along with the "NFA Weekly Newsletter" helps decide whether to keep an employee, prevents him from becoming automatically permanent through lapse of time without an actual decision being made. Form provides foremen with pertinent factors that enable reaching decisions and a convenient way of passing rating on to management on a uniform basis.

WHAT TO DO with breeze screened from cupola coke may be solved if the rainmaking business picks up enough. Weather engineers use pea size foundry coke impregnated with silver iodide in an acetone solution. When burned in a small crucible furnace the coke sends vapor aloft designed to form water droplets and cause rain from likely looking clouds.

PROTECTIVE COATING for magnesium alloys developed by the National Bureau of Standards is potentially more economical than other anodizing processes used while providing equivalent protection against salt-spray corrosion. Using low-voltage (10-12 v) alternating instead of direct current, the new process causes a coating to form on both electrodes. Bath contains, besides water, only sodium or potassium hydroxide and the corresponding chromate. Current of 80 to 140 amp/sqft through bath for 20-40 minutes, at 150-170 F, forms coating 1-2 mils thick. Coating is smooth and gray-green but not as uniform in appearance as the HAE or acid chromate coatings. If anodized panels are bent or flexed, coating cracks on tension side, chips or shatters on compression side.

GRAY IRON SHIPMENTS in 1955 should equal or exceed the 13.7 million tons shipped in 1953, second best year, according to Donald H. Workman, executive vice-president of Gray Iron Founders' Society. March operating rate of 93.8% of maximum commercial demand, highest since January 1951, was nearly matched by the June rate of 90.0%. Latter was bettered only in October 1951. Through May 1955 gray iron shipments were 6,117,000 net tons, 20.7% above shipments for the same period of 1954. Continued record breaking shipments are expected for the rest of 1955 and first half of 1956. Lead time on casting deliveries has had to be extended in many instances because of increased demands. GIFS attributes current heavy demand for gray iron castings to healthful conditions in the ten leading consumer industries which divide up the gray iron market as follows: automotive, 26.2%; building and construction, 9.5%; utilities, 8.5%; machine tool, 7.6%; agricultural, 6.7%; general machinery, 6.4%; household appliances, 4.7%; heating, 3.5%; and petroleum industry, 2.4%.

HOW PERMANENT does a mold have to be to qualify as "permanent?" We've been kicking this around ever since hearing about the pressure casting of steel car wheels in graphite molds (full story on pages 26-29). Now to add to our confusion comes the report that Rand Development Corp., Cleveland, has developed a new type of carbon mold good for 35 castings with the possibility of going to 100 after solving a surface oxidation problem. Unusual feature of the mold is its production by powder metallurgy techniques using carbon powder and a fibrous binder. Proposed applications include casting of titanium and cutting tool bits.

WHAT EVERY AUTHOR SHOULD KNOW about preparing papers for publications by the American Foundrymen's Society is given in the latest revision of the organization's "Guide to Authors." Included are suggestions for handling drawings and illustrations, preparation of manuscripts, writing style, deadline (December 15 for AFS Convention papers to be presented the following year), and basis for acceptance of papers.

Herbert P. Scobie

for the asking

able Sand Mixer

Your Mulling on Wheels", de-es how the 250-lb capacity Simp-Porto-Muller can be used for mix-molding, core, facing, and shell

Included are case histories, de-ion of variable mulling pressures, , and suggestions for use. *Nation-gineering Co.*

CIRCLE No. 37, PAGE 81-82

Ramming Mix

ge booklet provides comprehen-nformation on the use of Perma-165 and 84 ramming mixes for hearth and electric steel fur-Includes building forms, mixing sic refractory materials, and ram-them. Heat-up schedules and ma-estimating charts are also pro-*Kaiser Aluminum & Chemical*

CIRCLE No. 38, PAGE 81-82

og of Safety

58-page Occupational Safety Serv-uide 2.1 completely catalogs the and varied accident prevention vailable from the *National Safe-uncil.* Listed are tools to build safety programs, training aids for instructing supervisors and workers, a list of Council periodicals, newsletters, and a complete library of technical and administrative publications covering all phases of occupational accident prevention.

CIRCLE No. 39, PAGE 81-82

Electric Motors

28-page catalog GEC 1026 contains buying information on dc motors. Included are general and definite-purpose fractional horsepower motors, and fhp gear motors. A special section covers selection of integral horsepower motors. *General Electric Co.*

CIRCLE No. 40, PAGE 81-82

Arc-Air Process

Illustrated reprint of article describes the Arc-Air Process for cutting metal and tells why it performs on metals not readily oxidized. *Arcair Co.*

CIRCLE No. 41, PAGE 81-82

Roof Room Exhauster

Detailed information and performance tables of the new Axial Mushroom Power Room Exhausters are contained in Bulletin CAM-102. They are designed for use wherever roof ventila-

tion is applicable, with or without duct systems. Its low silhouette blends with contemporary buildings and can be concealed from the ground by parapet walls. *Chicago Blower Corp.*

CIRCLE No. 42, PAGE 81-82

Easy to keep **PERMANENT RECORDS**

OF SAND MOISTURE

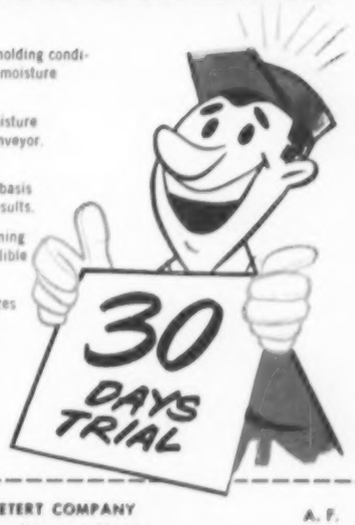
With the

DIETERT-DETROIT

MOIST RECORDER

1. No other single factor causes more variation in molding conditions and casting quality than fluctuations in the moisture content of molding sands.
2. The MOIST RECORDER tests and records the moisture content of sand in bin, hopper or on a moving conveyor. It doesn't miss a batch.
3. A continuous record gives your foundry an exact basis for correlating moisture variations with casting results.
4. Signal lights automatically indicate if sand is running above or below the desired moisture content. Audible alarms may be employed if desired.
5. The DIETERT-DETROIT MOIST RECORDER utilizes the proven, reliable high frequency capacitance method of moisture measurement. The unit is self-contained, compact, easily installed.

So confident are we that you will be completely satisfied with the benefits obtained, that we offer the MOIST RECORDER on a 30-day trial basis, without obligation.



HARRY W. DIETERT CO.
Control
EQUIPMENT

HARRY W. DIETERT COMPANY A. F.
9330 Roselawn, Detroit 4, Michigan
Rush me details on the Moist Recorder and your 30-day trial offer.

Name_____
Company_____
Address_____
City_____ State_____

CIRCLE No. 111, PAGE 81-82

Custom Built in
any Length, Width or Depth

ADAMS CHERRY EASY-OFF FLASK

These advantages will cut your production costs!

SIDES AND ENDS finished 1⅛" on all standard size flasks. 1¼" and heavier on flasks of larger perimeters and depths. Cherry lumber is finest available; air dried.

SOLID CORNERS are machine locked to maintain alignment and to insure maximum rigidity.

MALLEABLE TRIMMINGS are another famous Adams feature; assure long life and exceptional service.

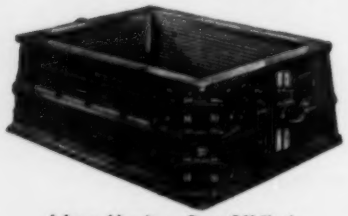
OPERATING MECHANISMS are completely new in design, yet of proven construction. Exceptionally simple, offering single-point adjustment; ease of operation on tough jobs.

ADJUSTMENTS made *only* when mechanism is in *locked* position.

SPECIALLY DESIGNED INSERTS located in main body castings permit reversal of locking position. As "standard" flasks are furnished with handles locking in "up" position. To change, remove main bolt handles and inserts, reverse inserts and handles and reassemble.

STEEL PROTECTING STRIPS are standard equipment at top of cope, bottom of drag and at parting. Aluminum strips available upon request at no extra charge.

WIDE "V" PINS & EARS standard on all flasks. All other types of pin and ear arrangements are available to interchange with your present pattern plate guides.



Adams Aluminum Easy-Off Flask

Adams Jackets, Cast Iron or Aluminum

Adams Steel Jackets

For the most complete line of flask equipment available . . . always look to Adams!

The ADAMS Company

ESTABLISHED 1863

MOLDING MACHINES and FLASK EQUIPMENT

700 FOSTER ST., DUBUQUE, IOWA, U.S.A.

CIRCLE NO. 77, PAGE 81-82

Disc Grinder

New Apex disc grinder has reversible disc, wrap-over tilt-back guard, permanent lubrication, counterbalanced table, and built-in dust collector among other features. *Rankin Bros. Engrg. & Sales, Inc.*

CIRCLE NO. 43, PAGE 81-82

Shell Molding System

Book 2462 describes a fully integrated, automatic shell molding system capable of producing up to 240 molds per hour. The four-station molding machine,

with closing machine, and all process equipment from sand preparation to handling finished castings has been proved in volume production. *Link-Belt Co.*

CIRCLE NO. 44, PAGE 81-82

Dust-Free Seacoal

More facts about improved—dust-free Hygeia seacoal are given in bulletin that discusses how to test the scatter pattern of seacoal and compare dust counts. *Penn-Rillton Co.*

CIRCLE NO. 45, PAGE 81-82

Measuring Hearing

"Guide for Industrial Audiometric Technicians" furnishes training and reference material for those learning to operate audiometers to conduct preemployment hearing measurements. *Employers Mutuals of Wausau.*

CIRCLE NO. 46, PAGE 81-82

Spectrographic Analysis

Introductory Bulletin 44 contains several bulletins on spectrographic analysis—two articles on use of the Direct Reader in two firms, and the 3-meter spectrograph in two other plants is described. Bulletin 32 describes the

operation and specifications of Baird spectrographs; the densitometer comparator is described in No. 34A. *Baird Associates, Inc.*

CIRCLE No. 47, PAGE 81-82

Refractory Line

Bulletin 317 discusses the properties and applications of corundum-base Taycor super-refractories, which are recommended to resist abrasion and iron oxide attack at high temperatures. *Chas. Taylor Sons Co.*

CIRCLE No. 48, PAGE 81-82

Industrial Fan Movie

Modern engineering and testing methods for industrial propeller fans is the subject of a new 16mm sound, color film. Described are three basic types of

axial flow fans, their inherent characteristics and methods of testing. Static pressure limitations of propeller fans, method of determining reliable fan performance, and rating data are also discussed. *Aerovent Fan Co., Inc.*

CIRCLE No. 49, PAGE 81-82

Portable X-Ray

The 1-million-v Van de Graaff portable x-ray generator has good sensitivity and definition on ½ to 5-in. steel sections with short exposure times. Self-contained design gives transportability not normal for units with this penetrating power. *High Voltage Engineering Corp.*

CIRCLE No. 50, PAGE 81-82

Smog & The Weather

"How Weather Influences City Smog," a 12-page pocket-size pamphlet, discusses the causes and effects of wind, mechanical and thermal air turbulence, stable and unstable atmospheric conditions on smog. Listed are seven steps to attack the smog problem. *Modern Equipment Co.*

CIRCLE No. 51, PAGE 81-82

Hot Blast System

Closer control of costs and melt with Whiting-Thermo hot blast system is

INDUCTION MELTING
with converter-operated furnaces . . .

Wherever metals are heated or melted in small quantities . . . for steel, non-ferrous or precious metal casting, sintering or hot pressing carbides, brazing . . . these self-tuning, low cost converter-operated furnaces are virtually standard equipment.

Ajax-Northrup converters are certified to meet F.C.C. regulations. Furnaces are available in sizes from 2 ounces to 120 pounds. (For large production—Ajax-Northrup generator-operated furnaces.)

Write for Bulletin 14.

AJAX NORTHRUP SINCE 1916

INDUCTION HEATING-MELTING

AJAX ELECTROTHERMIC CORPORATION • TRENTON 5, NEW JERSEY

Associated Companies: Ajax Electric Company—Ajax Electric Furnace Co.—Ajax Engineering Corp.

CIRCLE No. 78, PAGE 81-82

CUT CORE-MAKING 6 COSTS WAYS by the CO_2 Process

using STEINEX BINDER and HANSBERG CORESHOOTERS

1 ARE LARGE CORES A PRODUCTION BOTTLE-NECK IN YOUR OVENS? *You can now cut costs by hardening these cores in a few seconds by this CO_2 process.*

2 Eliminates drying ovens and their maintenance. Saves fuel and labor costs. GREATLY SPEEDS CORE-MAKING.

3 No waiting, no storage of cores necessary — cores hardened in the core box can be used immediately. Save a whole day's time on rush orders.

4 Nails, gaggers and wires are practically eliminated since core hardens right in corebox.

5 Because of the greatly improved accuracy with this method, casting tolerances may be held to a few thousandths of an inch.

6 Facing very large molds with Steinex Sand eliminates necessity of oven drying.

HANSBERG CORESHOOTER

Here is an entirely new type of core-making and shell-molding machine. It incorporates a new fundamental principle referred to as the "SHOOT." Uses very little compressed air. Economical for mass production and SHORT RUNS AS WELL. Incredibly fast production time is assured.

STEINEX BINDER

STEINEX is a remarkable core sand binder. Cores and shell molds, made of core sand mixed with STEINEX, can be hardened in a few seconds by the injection of carbon dioxide.

These cores and molds may be cast IMMEDIATELY.

PHONE OR WRITE FOR FULL INFORMATION AND LITERATURE

CARVER *Manufactured by* FOUNDRY PRODUCTS CO.

1054 HRESNBY AVENUE • AMherst 3-1848 • MUSCATINE, IOWA

CIRCLE NO. 91, PAGE 81-82

described in a recent bulletin. Employing a separately fired air heater, the system costs less initially, requires less supporting structure, takes up less space, and needs less maintenance. *Whiting Corp.*

CIRCLE NO. 52, PAGE 81-82

Conveyor and Elevator Belting

Care, maintenance and installation of conveyor and elevator belting are covered in 32-page booklet from *B. F. Goodrich Co.* Covered are: idlers, loading points, skirting, cleaning devices, turnover belt, pulley lagging, effects of moisture, light, and heat, repairing, how to specify belting, inspection, and other topics.

CIRCLE NO. 53, PAGE 81-82

Flexible Exhaust Hose

Accessories and installation, technical data, application data, and friction loss data of Flexaust hose and Portovent duct are offered in set of bulletins from *Flexaust Co.* These products are used for moving air, dust, fumes, and materials via pressure, suction, or gravity. Advantages include elimination of costly layout details, neat, fast installation by unskilled labor, easily cut, coupled, or cuffed on the job, exceptional resistance to aging, abrasion, acids, oils, and moisture.

CIRCLE NO. 54, PAGE 81-82

Foundry Practice Hints

Foseco Foundry Practice No. 3 is an 8-page bulletin with the following contents: "Shrinkage Porosity in Small Bronze Castings," "How Design is Affected by Foundry Practice," "Aluminum Sand Casting Defects No. 3," and "Scrap Diagnosis—Its Cause and Cure, Part 2". *Foundry Services Inc.*

CIRCLE NO. 55, PAGE 81-82

"Shell Molding and You"

16-page, pocket-size booklet is condensation of the new G-E sound-slide color film "Shell Molding and You." Included are history of metal working; development of shell molding; shell tolerances, casting structure, production, metal savings, reduced labor costs, and versatility. *Chemical Materials Dept., General Eelctric.*

CIRCLE NO. 56, PAGE 81-82

Ultrasonic Cleaning Equipment

Features of Model DR-400 ultrasonic metal cleaning equipment is described in bulletin from *Acoustica Associates, Inc.* Parts submerged in a cleaning solution are cleaned by above-audibility sound waves which cause copious cavi-

tation, the continuing formation and collapse of millions of entrapped vapor bubbles. Local forces set up by each collapsing bubble are enormous, and cleaning solution is literally shot between the piece and the contamination.

CIRCLE NO. 57, PAGE 81-82

Panel Meters

Bulletin G-9 lists various types of clear plastic case panel mounting meters as well as black bakelite case styles. Also shows some of the new more rugged sealed models. Indicating pyrometers, both panel mounting and portable types are listed. *Assembly Products.*

CIRCLE NO. 58, PAGE 81-82

Sandblast Equipment

The 1955 "Sandblast with Clemco," 20-page catalog is now available. Fourteen different models from 150 lb to 1350 lb sand capacity are described and illustrated. Also shown are the latest in accessory items to fit all existing sandblast units—sand control valves, Venturi nozzles, remote control valves, quick couplings (externally fitted), new light-weight, more flexible sandblast hose. *Clementina, Ltd.*

CIRCLE NO. 59, PAGE 81-82

Vacuum Degassing

"A Practical Method for Vacuum Degassing of Non-Ferrous Metals" tells how the Naval Research Laboratory used a vacuum in place of chemical or gas flushing treatments on aluminum alloys. *Kinney Mfg. Div.*

CIRCLE NO. 60, PAGE 81-82

Wet Dust Collector

Pangborn centrifugal wet collector for handling hot, moist, inflammable, abrasive, corrosive, and obnoxious dusts is described in Bulletin 919. Several stages of special vanes direct air in such a way as to give performance not hitherto available in wet-type collectors. *Pangborn Corp.*

CIRCLE NO. 61, PAGE 81-82

Cut Slag Inclusions

How casting defects caused by slag inclusions resulting from erosion or refractory lining can be eliminated by using high fusion point, lining mix Luxit #5 Special is told in Bulletin AL-35. *Alpha-Lux Co., Inc.*

CIRCLE NO. 62, PAGE 81-82

Gas Welding Torches

Complete data and specifications about Marquette's five entirely new oxy-

Keeping Gray Iron "out front" is your job...and ours

Selling Gray Iron as a truly *modern metal* in the face of tough competition is *your* job as a foundry operator . . . and *our* job as an association. That it's a winning battle is demonstrated by the consistently high production rate now enjoyed by the Gray Iron industry.

An important element in this success is *good communications* . . . both within the industry itself, and with potential customers. Providing such communications is a prime job of the Gray Iron Founders' Society, a strong national organization of top Gray Iron producers, large and small, captive and commercial.

Every Gray Iron foundry, of course, benefits to some extent from Society activities. But to obtain the *full benefits* of its many programs, you need the regular and stimulating communications that go with active Society membership. For example:

Look what Society membership gives you . . .

Studies on improved foundry management are made immediately available to members. Facts revealed in special studies, Society publications and in local management and cost meetings can be quickly related to your own foundry operations. For example, suggestions for more accurate accounting and price estimating procedures alone can add to your profits.

New techniques, business and technical information from authoritative sources associated with the Society cover reports on research, production, raw materials, equipment and on other special problems. This important information is quickly released to members. Production data alone may lead to increased profit potential for you by reducing internal costs. In addition, a permanent and professional Society staff is ready always to assist members and their customers with individual problems by answering questions of a technical or business nature.

Sales prospects for members . . . The Society concentrates its national advertising in the trade and technical publications read regularly by castings buyers. This advertising stresses Gray Iron's engineering properties and design possibilities. The Society emblem is prominently featured as a symbol of good service and efficient foundry practice. Consistent advertising is helping to make this emblem more important to buyers. And because of this, the Society has gained broad recognition and acceptance as a source of Gray Iron information to castings buyers.

Statistical data, terms and conditions of sale, data on how to combat competitive metals, two-way communications with government officials . . . these important Society services are of practical dollars-and-cents value to you.

* * *

This broad-gauge job of providing both internal and external communications for the Gray Iron industry is vital to *your* business. To take a stronger and more active part in this task . . . to better equip yourself for your own personal selling job . . . let the Society work for you and with you. The cost of Society membership and assistance is very low. Mail the coupon for complete information on Society services.

GRAY IRON FOUNDERS' SOCIETY, INC.
National City-East 6th Building, Cleveland 14, Ohio

Please send me full information describing Society services and how they will benefit me.

Company _____

Name _____ Title _____

Address _____ City _____ State _____

GRAY IRON FOUNDERS' SOCIETY

CIRCLE NO. 84, PAGE 81-82

tell about the heavy duty Super-Jet, the medium duty Star-Jet, light duty Aero-Jet and the Jet-O-Matic (an automatic version of the aircraft torch) and the Master Cutting Equipment. Advantages of Aluminum handle construction are described as well as the new design which makes these torches stronger, lighter and cooler operating. *Marquette Mfg. Co.*

CIRCLE No. 63, PAGE 81-82

Compressed Air Systems

Bulletin 711 offers suggestions in realistic cost accounting of compressed air systems, a chart covering moisture content of compressed air, illustrations and specifications for Adams aftercoolers, cyclone separators, and Poro-Stone air filters. *R. P. Adams Co., Inc.*

CIRCLE No. 64, PAGE 81-82

Hints on Magnets

24-page booklet B-213 features descriptions of how "magnetic ideas" have been applied with engineering know-how to solve many vexing problems. *Eriez Mfg. Co.*

CIRCLE No. 65, PAGE 81-82

Sand Conditioners

"NY" series of sand separators and blenders for high-capacity sand systems in semi-mechanized, small to medium foundries, are described in Bulletin NY-54. *Royer Foundry & Machine Co.*

CIRCLE No. 66, PAGE 81-82

Automatic Heat Treat

Bulletin T-40 describes Series TFS Automatic heat treating units with controlled atmosphere under cooling, has drawings, and photographs. *Ispen Industries, Inc.*

CIRCLE No. 67, PAGE 81-82

Air Compressors

16-page Catalog 5510 describes Unistage industrial air compressors, of ½ to 150 hp; belt or direct motor driven; extras include air receivers and accessories; manual and magnetic starters available. *Schram, Inc.*

CIRCLE No. 68, PAGE 81-82

Industrial Trucks

24 cost-cutting ideas with industrial trucks are described through case examples in new bulletin. *Elwell-Parker Electric Co.*

CIRCLE No. 69, PAGE 81-82

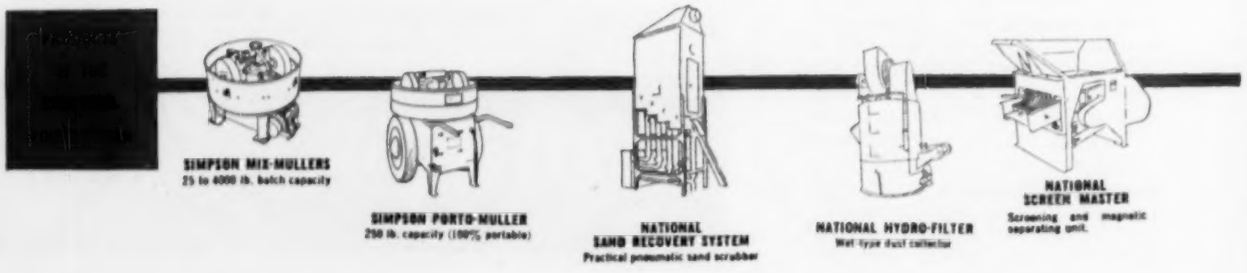
Shell Cores

Shal-Tec Bulletin 306 describes how to produce shell cores for experimental purposes without special equipment an offers technical advice on the blowing of shell cores with shell core blow-

Photo above shows new, compact Mix-Muller installation at Forging & Casting Division, Allegheny Ludlum Steel Corp., Ferndale, Michigan. Unit includes No. 1½F (1000 lb.) Simpson Mix-Muller, National Bucket Loader and National Aerator. National TIME-MASTER controls entire operation in preparing facing, backing and core sand.

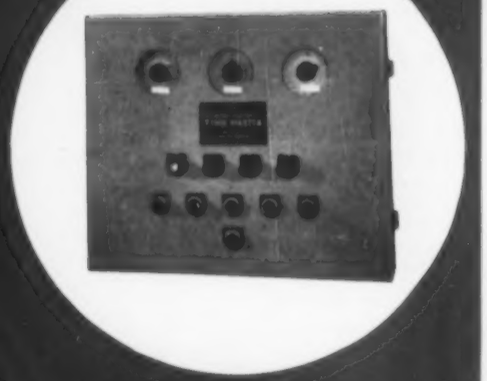
CONSOLE MODEL: An alternate, desk type control panel for the National Timemaster can be provided for convenient location anywhere in the foundry.

TYPICAL control panel arrangement for Timemaster operation of two No. 3F (4000 lb.) Mix-Mullers. Dials above inspection doors indicate moisture content of batch—through National "Moisture-Master."



NATIONAL

TIMEMASTER®



ON FACING SAND: The number of quarts of water required is set on the panel of the Timemaster control unit. The total cycle is set for mulling and the knob is turned to automatic. When the start button is pushed all phases of mulling are automatic—indicating lights reveal the sequence of operation. After mulling the discharge door opens and mixer is discharged by plow action.

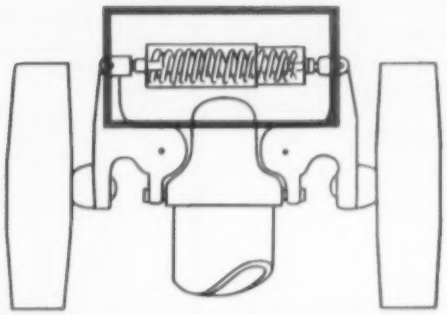
ON BACKING SAND: The backing sand operation is similar to the facing sand mulling sequence. Total cycle time may vary as well as may the moisture additions. The operator re-sets two knobs and the Timemaster again controls the phases of mixing. Quality and uniformity are greatly enhanced.

ON CORE SAND: Quarts of water are set on one dial, quarts of oil on another and total cycle adjusted on the third to automatically provide the proper mixing cycle for core sand mixing. Water and oil, accurately measured and automatically injected into the batch at the proper time, relieve the mixer operator of these tasks and insure maximum uniformity and quality.

AT THE TURN OF A SWITCH you can eliminate the "human element" from your mixing operations with the National Timemaster. Designed to increase production by effective coordination of all phases of the mixing cycle, the Timemaster can also make quality control a reality in your foundry and—automation an everyday tool—working for you. Write today, for details.

Spring loaded mullers mean more mulling per minute . . . per dollar invested.

NOW AVAILABLE on Simpson Mix-Muller models in a batch capacity range of from 50 to 4000 lbs., spring loaded mullers provide the ultimate in control over *every minute* of the sand mixing operation. With this unique innovation, it is possible to *pre-set* muller weights according to the type of sand to be mulled. Maximum muller pressure is exerted as the sand increases in strength during mulling — when pressure is *most* needed.



National Engineering Company
(Not Inc.)
630 Machinery Hall Bldg. • Chicago 6, Illinois

ing equipment. Covered also: core box design, temperature, mixes, pressures, wall thicknesses, core removal, complex cores, and shell core costs. *Shalco Engrg. Corp. and Shallway Corp.*

CIRCLE NO. 70, PAGE 81-82

Cut Foundry Dust

Technical Bulletin FR-126, "Quick Steps Towards Foundry Cleanliness," describes how some recently developed products can help hold foundry dust to a minimum and also details other products that can make working conditions cleaner and more healthful. *Frederic B. Stevens, Inc.*

CIRCLE NO. 71, PAGE 81-82

Colloidal Graphite

The following uses for Dag Colloidal Graphite in the foundry are given in Bulletin 425: for chills, for permanent mold coating, for lubricating shoulder screws and base plates, for pattern coating, for flask pin coating, and for push pin coatings. *Acheson Colloids Corp.*

CIRCLE NO. 72, PAGE 81-82

Magnetic Elevators

Homer Magnetic Conveyors convey ferrous parts up inclines as steep as 90 degrees. Feed point can be at floor level or at any height on the conveyor. Considerable floor space is saved. *Homer Manufacturing Co., Inc.*

CIRCLE NO. 73, PAGE 81-82

Shell Machine

Chicopee Twin Model DSM3 shell molding machine taking 20 x 20-in. patterns at both stations is described in Catalog 4-1m. Shells for two different jobs can be produced at the same time. *Shell Process, Inc.*

CIRCLE NO. 74, PAGE 81-82

Materials Handling

48-page, pocket-size "What We Make," includes drive and conveying chains; transmission, elevating, and conveying machinery; feeders, separators, pulverizers, and portable and stationary sand conditioning equipment. *Jeffery Mfg. Co.*

CIRCLE NO. 75, PAGE 81-82

Sand Test Equipment

Construction and application of the Gordon-Campbell line of foundry sand testing equipment are described in 4-page bulletin No. 3600-55. *Claud S. Gordon Co.*

CIRCLE NO. 76, PAGE 81-82

◀ CIRCLE NO. 100, PAGE 81-82

Sensational Sale!

Exciting Savings on Publications for your Reference Library!

NEW AFS FOUNDRY VENTILATION BOOKS

Six Sections Available in Four Books... for the price of ONE

***Section 1*—GENERAL PRINCIPLES OF FOUNDRY VENTILATION AND FOUNDRY HYGIENE PROBLEMS**

Treats more common elements in foundry environment, some of which are: beryllium, lead, resins, silica, phosphorus. Describes characteristics of air flow, types of exhaust systems; explains recirculation, methods of supply air, general ventilation. (20 pp. 8x11 Paper Bound. 11 Illustrations)

***Section 2*—EXHAUST HOODS AND SYSTEM DESIGN**

Explains fundamental theory of hood design; provides step by step methods of designing exhaust systems; illustrated by many figures and engineering data. (Included with Section 3)

***Section 3*—PRACTICAL DESIGN OF SAND-HANDLING VENTILATING SYSTEMS**

No technical knowledge required; contains practical information for designing and balancing a sand handling ventilation system. (34 pp. 8x11 Paper Bound. 60 Illustrations)

***Section 4*—MOLDING AND CORE MAKING PROBLEMS**

Written principally with the manual shop in mind, but includes specific information on shell molding, sand slingers, application of foundry facings, etc. (Included with Section 5)

***Section 5*—GENERAL PRINCIPLES FOR MELTING AND POURING OPERATIONS**

Explains simple ventilation principles involved; for ferrous and non-ferrous work; offers illustrations of typical methods of ventilating specific operations; a non-technical section for practical use. (18 pp. 8x11 Paper Bound. 34 Illustrations)

***Section 11*—MAINTENANCE AND TESTING**

Tells how to maintain and test exhaust systems; saves money by showing how to avoid breakdowns and replacement of equipment. Describes more common instruments used in testing industrial ventilating systems. (16 pp. 8x11 Paper Bound. 28 Illustrations)

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CIRCLE NO. 129, PAGE 81-82

let's get personal

David Swan has been appointed director of research, Metal Research Laboratories, Electro Metallurgical Co., Div. Union Carbide & Carbon Corp., New York. He will be located at Niagara Falls, N. Y.

Carl E. Rowe has been appointed vice-president in charge of manufacturing for the Pressco Casting & Mfg. Corp., Chesterton, Ind. **William J. Brinkman** has been appointed vice-president in charge of engineering.

Carl E. Haugh, formerly of Hydropress, Inc., has joined Continental Foundry & Machine Co. in sales for rolling mills and heavy machinery. He will be in the engineering and sales headquarters in Pittsburgh.

Ralph E. Forsman has been appointed to the sales staff of Basic Refractories, Inc., Cleveland. He will be located in Philadelphia.

John W. Wheeler has been appointed an abrasive engineer by Norton Co. for the western Massachusetts area succeeding **Robert H. Langdon** who was appointed district manager for New York state and northern New Jersey.

Michio Tanji, vice-manager of No. 2 production department and foundry manager, Mitsubishi Heavy Industries, Nagoya, Japan, **T. Ida** of the company's New York branch, and **D. Ishida,** vice-president of Industries Export Corp., Chicago, conferred with staff members at the Technical Center, American Foundrymen's Society, Des Plaines, Ill., recently. Mr. Tanji is visiting Meehanite and light metal foundries in the U. S.

The board of directors of the Pangborn Corp., Hagerstown, Md., has been increased from five to seven. **Thomas B. Butler** and **Mrs. Helen R. Fisher** are the new directors. **Thomas W. Pangborn,** president; **John C. Pangborn,** first vice-president; **P. J. Potter,** vice-president; **Victor F. Stine,** vice-president; and **Lloyd L. Stouffer,** vice-president, were re-elected to the board. Lloyd L.

Carl E. Rowe

David Swan

Stouffer, formerly secretary-treasurer, was elected vice-president, Mrs. Helen R. Fisher, formerly assistant secretary, was named secretary and **John R. Bell**, formerly assistant treasurer was made treasurer.

Dale A. Brown

Directors of Bohn Aluminum & Brass Corp. have elected **Dale A. Brown** a director of the corporation. Mr. Brown presently is managing Bohn's Plants 6 and 12 at South Haven, Mich.

John B. Davies, manager of industrial sales, Mine Safety Appliances Co., Pittsburgh, was elected president of the Industrial Safety Equipment Association.

R. A. Entringer has been appointed general sales manager of Alcaloy, Inc., Trenton, N. J.

Earl W. Beyerlein has been appointed casting buyer for the Axel Div., Cleveland, and the Forge Div., Marion, Ohio, of the Eaton Mfg. Co. His office will be in Cleveland.

Earl W. Beyerlein

More and more foundrymen are using *Moly*. They like *Moly's* 3 Advantages:

ABUNDANT • At Climax's Colorado mine, there's enough molybdenum to supply all the free world's needs for at least 35 years at the present rate of consumption.

EASY TO USE • Moly can be added to most grades of cast iron without changing character of charge, normal melting practice, or the base metal. No balancing is necessary. Moly is neither a graphitizer nor a strong carbide former. Moreover, effective additions are so small they can be made at the spout or in the ladle because the cooling effect on the iron is insignificant.

EFFECTIVE • Moly not only adds strength to a casting but can do more. You can get:

Strength plus toughness

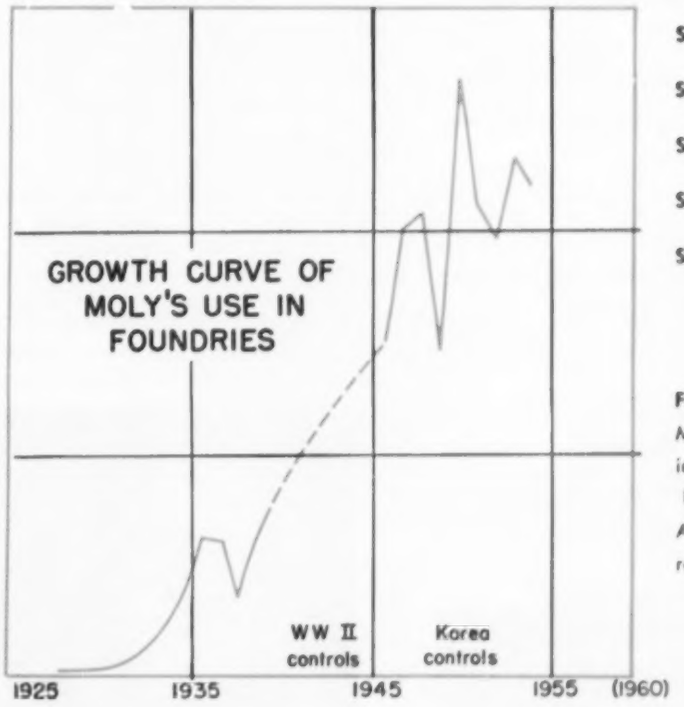
Strength plus growth resistance

Strength plus response to heat treatment

Strength plus wear resistance

Strength plus elevated temperature properties

Strength plus uniformity in heavy and varying sections



For engineered castings — get better results with Moly. If you would like to add your name to our mailing list for a series of leaflets on Moly Iron — address Dept. 52, Climax Molybdenum Company, 500 5th Avenue, New York 36, N. Y. The first leaflet is now ready for you. Write today.

M55-18

CLIMAX MOLYBDENUM

CIRCLE NO. 101, PAGE 81-82

Precision Metalsmiths, Inc., Cleveland has appointed **W. F. Krahl** sales representative for Illinois and Wisconsin.

Richard S. Reynolds, Jr., president of Reynolds Metals Co., has been elected a term trustee of the University of Pennsylvania.

Gavin C. Paterson, a director of Paterson Hughes Engineering Co., Ltd., London, England, visited the Technical Center of the American Foundrymen's Society recently for a discussion of air pollution control and foundry mechanization problems.

Alan D. Kattelle has been appointed assistant general purchasing agent of the American Brake Shoe Co.

Robert Duffy has been appointed district manager of the Milwaukee sales territory of Lindberg Engineering Co., Chicago. He succeeds **Robert Onan** who will take over as president of the Waukee Engineering Co. **Robert Foley** succeeds Duffy in Chicago.

John W. Shier

Bart C. Dickey

Electro Refractories & Abrasives Corp., Buffalo, N. Y., has created three new district manager positions in its grinding wheel division. **Carryl A. Asher,** vice-president, has been appointed eastern sales manager; **A. D. Stover,** district manager for the Detroit area, and **John Hume, Jr.,** district manager for the Chicago area.

Walter C. Schonhoff has been appointed chief engineer of Wayne Foundry & Stamping Co., Detroit. Formerly sales engineer, he replaces **Andrew Gawura** who retired from the company to return to active management of Mercury Pattern Co., Dearborn, Mich.

John R. Tuttle became president and chairman of the board of Crouse-Hinds Co., Syracuse, N. Y., July 26. On that day, three other executives, **William L. Hinds,** chairman of the board; **Albert F. Hills,** president, and **W. C. Blanding,** executive vice-president, retired from active management. The three men will continue as members of the board of directors.

John W. Shier has been appointed assistant general manager of the Acheson Colloids Co., Port Huron, Mich. He was the company's production manager, and **Bart C. Dickey,** formerly process development engineer, has been promoted to fill this position. **Fred Zajac** was appointed Detroit service engineer replacing **Frank M. Hunter,** who is returning to headquarters at Port Huron where he will supervise the laboratory phase of the company's sales engineering program.

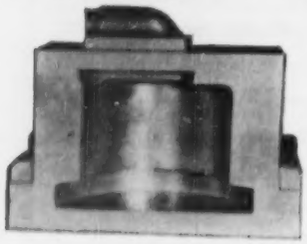
Bernard D. Cox, formerly sales promotion head of an Aluminum Co. of America subsidiary, has been named advertising manager of Rockwell Manufacturing Co's. Delta Power Tool Div., Pittsburgh.

A. P. Bagchi, metallurgist, and **S. S. H. Cahoon,** Tata Locomotive & Engineering Co., Jamshedpur, India, visited the Technical Center of the American Foundrymen's Society recently. They are in

John R. Tuttle

William L. Hinds

METAL CORE BOX?



It looks and Works like Metal Because its coated with --

MABCO Aluminum Pattern Paint

Over 1200 Foundries have learned that it is possible to have high grade patterns and core boxes (like the one shown above) at about one-fourth the cost of metal simply by coating wood and cast-stone with MABCO Aluminum Pattern Paint.

Check These Outstanding Features --

- *Quick Drying Paint on, metallic Aluminum coating which may be sanded, filed or machined when dry.*
- *Not affected by synthetic Binders*
- *Hot sand does not stick to coating.*
- *Impervious to moisture and most solvents.*
- *Coats wax and leather fillets so liquid parting may be used.*
- *Coats wood patterns for longer life and slick draws.*

Use these other Mabco Aluminum Plastic Products

MABCO Aluminum Plastic

An excellent product for filling nicks and chips in wood or metal patterns and will fill holes in any type castings. MABCO Aluminum Plastic will not crack, chip or drop out. Makes a superior Metal Fillet material.

MABCO Thinner

The only solvent for use with MABCO Pattern Paint and MABCO Plastic. The binder will not release ordinary solvents and the mixture will be rendered useless.

Write today for literature on these Outstanding Products.

M. A. BELL COMPANY

218 Lombard St. St. Louis, Mo.

Serving the foundry industry for over 25 years

HOUSTON DENVER

CIRCLE NO. 107, PAGE 81-82

the United States on a 5-month study of operation and maintenance of foundry equipment. The equipment is similar to that planned for a new, completely mechanized steel and iron foundry scheduled to go into operation early in 1957 for production of steam locomotive and diesel truck castings.

Ashley B. Sinnett

Ashley B. Sinnett, educational director of the American Foundrymen's Society, has been named assistant secretary. He will carry on with foundry educational work in addition to his new administrative duties. Sinnett joined the AFS staff April 1, 1954, after two years teaching foundry practice, patternmaking, and manufacturing processes at Michigan State University. He has a BA degree (1952) from MSU in industrial arts and vocational education with a minor in mechanical engineering (mostly foundry and physical metallurgy) and an MS degree (1954) from the same school. He graduated from high school at Lufkin, Texas, and after three years in the navy went to Michigan State. During vacations he worked in industrial foundries.

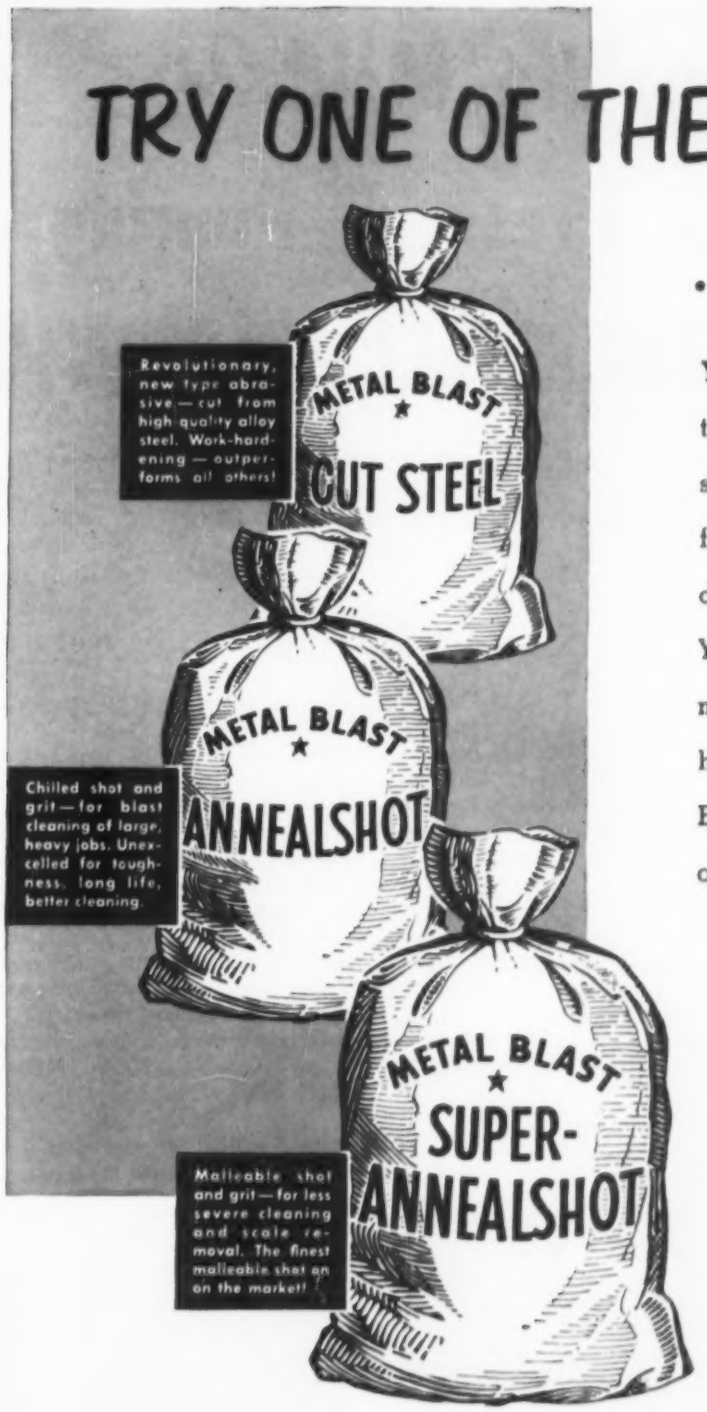
Orville T. Barnett has been promoted to assistant manager of the metals research department at Armour Research Foundation of Illinois Institute of Technology, Chicago.

Glenn O. Logan was promoted to division manager of Atlanta Sales Div., Cleco Div., Reed Roller Bit Co., Houston, Texas.

Arthur H. Luchs has been appointed vice-president of Dickey

continued on page 71

TRY ONE OF THESE THREE ...and SEE!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CIRCLE NO. 86, PAGE 81-82

9 tons of 0.75% carbon steel is lowered into steel pressure tank.

Graphite Molds + Air Pressure Pouring = NEW STEEL CAR WHEELS

You could call this new casting method die casting or permanent mold casting; but whatever you decide to call it—it works!

H. H. Hursen, / *Operating Asst.*
Griffin Wheel Co., Chicago

■ For over 75 years, the author's company has been manufacturing chilled-iron freight car wheels. During this period, over 48 million wheels have been produced for railroads throughout the world.

A railroad car wheel must be of excellent quality. It is subjected to more physical abuse than any other component of a freight car. In its primary function as a load carrier, it is continually subjected to enormous repetitive stresses at all speeds. The wheel must also withstand extremely high internal stresses developed when the tread is heated by friction accompanying brakeshoe application when a train is stopped.

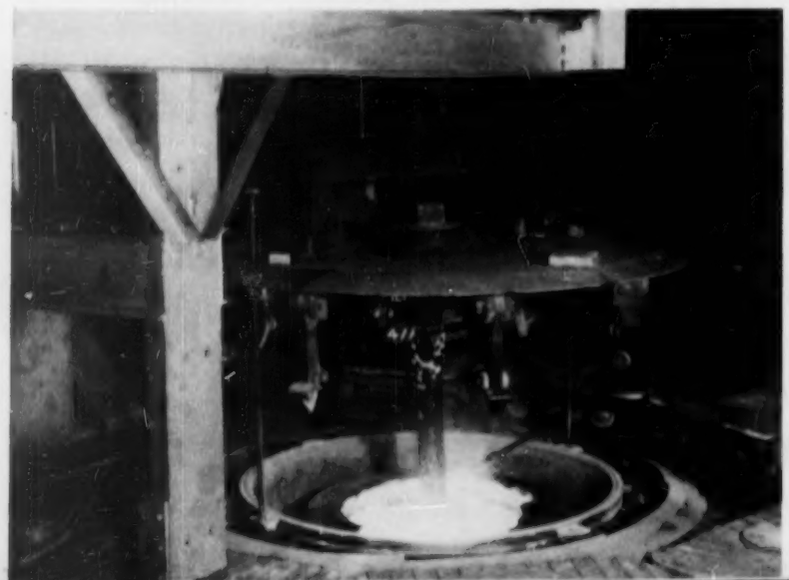
With the advent of the high-powered diesel locomotive, a new concept of freight service has evolved. The cars are larger and carry greatly increased loads at speeds which were inconceivable a few years ago. Consequently the abuses which wheels were formerly required to absorb have been increased considerably.

To meet this new challenge, the author's company developed a new steel car wheel and a unique method of production which involves the use of air pressure pouring and graphite permanent molds.

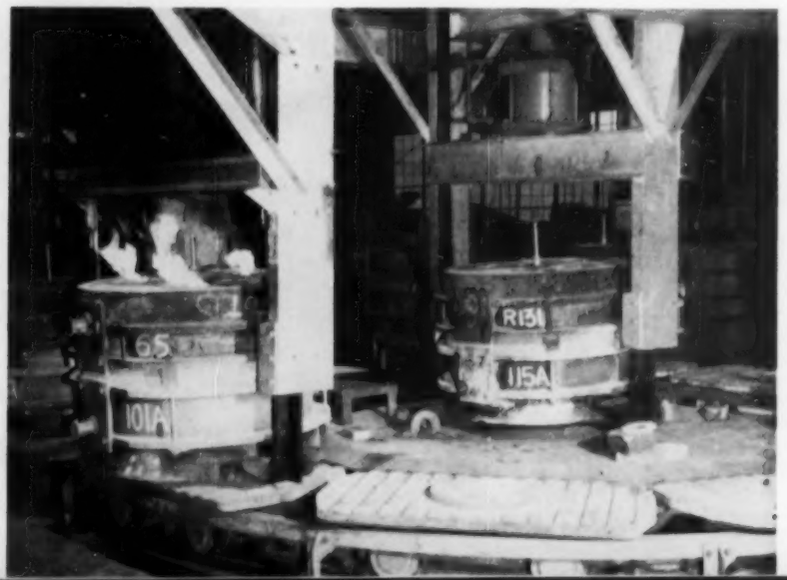
Our present phase of research extends over the past ten years. Five different methods of making an improved car wheel were investigated and discarded as unsatisfactory. American Steel Foundries, the writer's parent company, had previously produced a conventionally sand cast steel wheel which was satisfactory from the standpoint of serviceability but was abandoned for economic reasons. Because of surface defects encountered in sand casting of steel, corrective and cleaning costs were prohibitive.

In view of this, it was reasoned that if a permanent mold process,

Gasketed cover, when placed over the pressure tank puts the refractory pouring tube protruding from its center to within 2 in. of ladle bottom.



As one filled graphite mold is removed to the conveyor the next mold is placed on top of the pouring tube and secured by hydraulic clamps.



which would eliminate the use of sand and its inherent cleaning problems, could be utilized, a possibility of economically producing a sound wheel existed. From this came the development of the graphite mold process.

Graphite is admirable as a permanent mold material for steel castings because:

- 1. It cannot be heated to the fusion point by the extremely high pouring temperature required for steel castings. Consequently, the casting never sticks to the mold and a perfect surface is obtained.
- 2. It is one of the few materials which has sufficient thermal shock resistance to withstand the high temperature of molten steel without cracking.
- 3. Its low coefficient of expansion and ability to resist distortion when subjected to extreme thermal gradients, insures that each successive casting produced from the same mold will have exactly the same contour and dimensions.
- 4. It is readily machined and in the event that the mold surface is physically damaged, it can be easily and quickly restored to a perfect contour by a simple re-machining operation.

Overcome Graphite Shortcomings

It should be noted that graphite is a relatively weak and soft material and consequently is susceptible to physical or mechanical abuse. The problems presented by this shortcoming were readily solved by the proper design of mold handling equipment and adequate personnel training.

The first graphite blocks produced for this project were 42 in. in diameter and 15 in. thick. They were the largest ever made.

In our initial attempts to pour steel into a graphite mold, conventional gravity pouring from a bottom-pour ladle was tried. It was quickly learned that this practice would not be acceptable. This was because graphite possessed one very undesirable characteristic which precluded the possibility of introducing the molten metal through a conventional pouring basin in the top of the mold.

Mold erosion developed. The long drop from the ladle to the mold cavity caused the metal to splash and impinge on the graphite. Large areas of the mold surface were washed away making the surface unfit for further use.

Also, because of the high conductivity of the graphite mold, the severe splashing which accompanied gravity pouring consistently caused numerous surface defects on the casting, such as imbedded cold shots, laps, scabs and wrinkles.

Develop Pressure Pouring

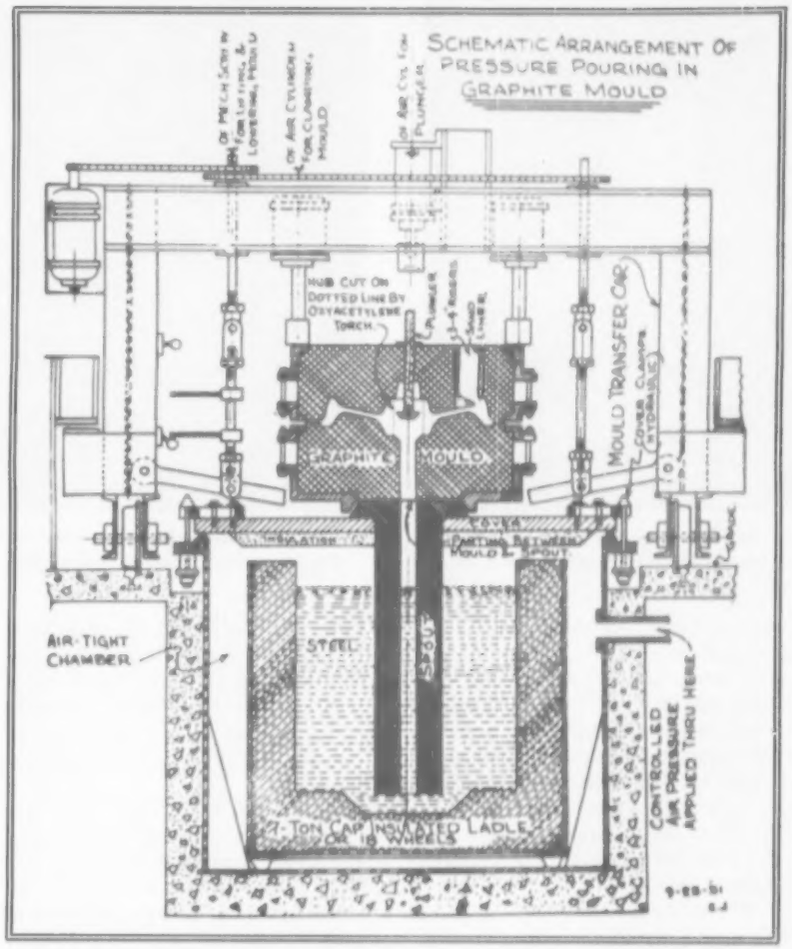
From these experiences it was realized that if graphite molds were to be successfully used, a method of controlled pouring would have to be devised. It was to comply with these requirements that the currently used pressure pouring process was conceived and perfected.

In principle, pressure pouring is merely forcing molten metal up through a refractory tube and into the bottom of a permanent mold cavity by means of compressed air. The height to which the metal may be raised is dependent only upon the maximum air pressure applied. Each increase of 1 lb in air pressure will lift the molten steel approximately 3¼ in. The rate of pouring is determined simultaneously by the rate of air pressure increase and the inside diameter of the pouring tube.

In practice, the process consists of tapping 18,000 lb of 0.75 per cent carbon steel into a ladle. Because no stopper seat or pouring lip is required, the construction of the ladle is simple. It is a closed bottom steel cylinder lined with conventional ladle lining brick.

Pour at Optimum Temperature

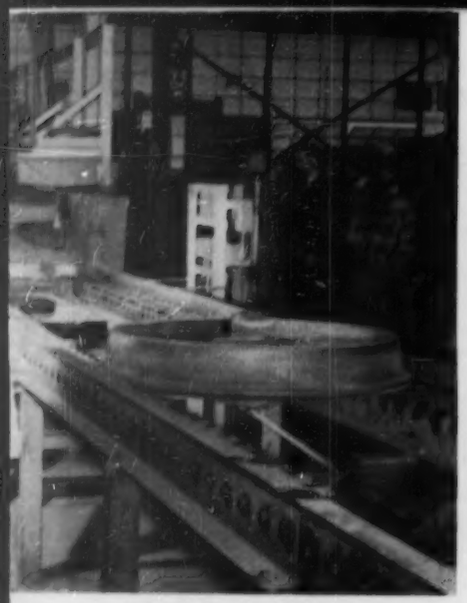
At the completion of the tap, to insure the cleanest possible steel, the ladle is transferred to a slag pot where the slag is skimmed off. After slagging is complete the ladle is transferred and lowered into a heavy-walled steel pressure tank imbedded in concrete in the foundry floor. Temperature of the steel is then determined with a Pt: Pt-Rh immersion thermocouple. Experience indicates that optimum pouring results are obtained when the metal temperature is within the range of 2920 to 2970 F. If the tem-


SCHEMATIC ARRANGEMENT OF PRESSURE POURING IN GRAPHITE MOULD
GRAPHITE MOULD
MOULD TRANSFER CAR
AIR-TIGHT CHAMBER
STEEL
7-TON CAP. INSULATED LADLE ON 18 WHEELS
CONTROLLED AIR PRESSURE APPLIED THRU HERE

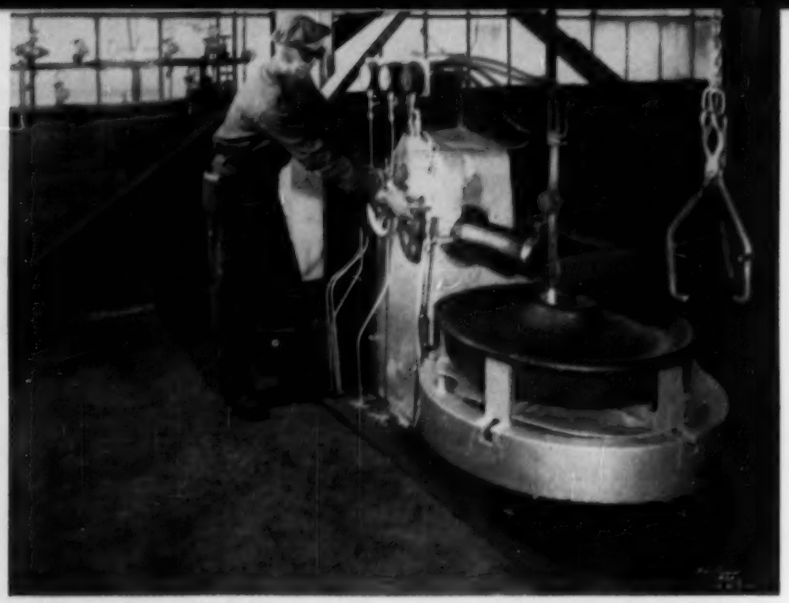
Schematic diagram of ladle-mold arrangement showing sub-floor pressure chamber, bottom poured graphite mold, and securing-transfer mechanism.

Risers remain in the cope as it is lifted 5 min after pouring.

Frozen-in pouring stopper makes removing wheel from drag easy.



Insulated tunnel controls cooling rate of wheels on conveyor.



Wheel hub bore hole is cut out with the specially designed oxy-acetylene torch cutting machine using the frozen-in hollow stopper as a pilot.

Resin-sand riser hole liner is formed in the hot graphite cope.

perature is much above this range, the mold may suffer damage, and if it is much lower, poor casting surfaces may result.

When the correct temperature is indicated, a heavy steel cover with a refractory pouring tube attached to and protruding down from its center is placed over the tank with the tube submerged in the molten metal.

The cover is held tightly in place by a number of hydraulic clamps. A rubber gasket between the cover and tank seals off any air leaks which otherwise might exist.

80 Tons Force on Cover

The hydraulic clamp system of securing the cover to the tank is necessary because of the large surface area of the cover. At times during the pouring process, air pressure up to 22 psi is applied to the tank. Under these conditions as much as 80 tons pressure is forced against the underside of the cover.

With the cover in position the pouring tube reaches within 2 in. of the bottom of the ladle.

After the cover is tightly clamped in place, a closed mold is mechanically placed on top of the pouring tube where the latter protrudes up slightly from the center of the cover. By means of a push button control, the mold is clamped down tightly in place by two heavy rods actuated by two 8-in. air pistons. These hold-down rods serve two purposes. They hold the mold firmly seated on top of the pouring tube and also keep the mold halves tightly closed thus preventing ferrostatic pressure from lifting the cope and causing a runout at the parting line.

After the hold-down rods are firmly in place on top of the cope, the actual pouring is started by flipping open a quick acting valve located in the air line to the pressure tank. As the air pressure gradually increases in the tank, the steel gently flows up the tube and into the mold.

The pouring rate, which has been determined by experiment, is constant and exactly as required. The rate of flow is under control at all times and never varies as it does in the case of bottom-pour ladles where the pouring rate varies with the head, or the amount of metal in the ladle.

Quality from Quick, Quiet Pour

The metal does not gush or splash in a manner which would cause mold erosion, but flows quietly and quickly into the mold at a sufficiently rapid rate to produce a casting of excellent finish and completely void of surface defects.

The pouring rate determined to be satisfactory for wheels is approximately 150 lb per second or an air pressure increase of ½ lb per second.

The design and construction of a satisfactory pouring tube was one of the most crucial phases encountered in the development of the pressure pouring process.

The requisites of a satisfactory pouring tube are:

- 1. It must be highly refractory to resist softening when submerged in 2950 F molten metal.
- 2. It must resist the extreme thermal shock which occurs when suddenly submerged in the hot steel.
- 3. It must be air tight. If it is not, the compressed air above the metal line in the ladle will seep through the tube and cause a regular bessemer blow in the tube and mold and result in a defective casting.

Metal Drain from Mold Stopped

Despite the vast amount of research expended on the development of the presently used tube, its performance is not entirely satisfactory. However, the solution of the problem is now in sight.

Obviously, after the mold is full, some means must be available to keep it full and prevent the metal from draining back into the tube when the air pressure is exhausted from the tank. This is accomplished by the use of a stopper similar to that used in a bottom-pour ladle.

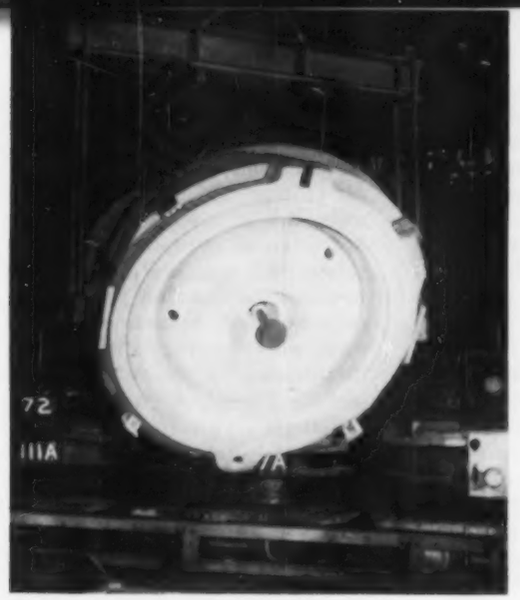
The stopper consists of a graphite plug fastened to the end of a 27-in. long piece of ¾-in. steel pipe. In use, the stopper is positioned in the cope so that it hangs just 2 in. above the stopper seat in the drag with the upper portion of the pipe extending up several inches above the top of the cope.

In actual practice after the air has been turned on, the operator observes one of the riser holes in the top of cope and when the metal reaches the proper height he pushes a button. From this point, the remainder of the process progresses automatically until the next mold is ready for pouring.

When the button is pushed after the mold is full, an air-actuated plunger contacts the top of the stopper pipe and seats the stopper. Immediately after this the air valve is automatically closed and the tank is exhausted. This allows the metal in the pouring tube to drain back into the ladle. Three seconds later an automatic timer causes the stopper plunger to retract, and 18 seconds after the button was pushed, the hold-down rods retract automatically.

Simultaneously, the mold is automatically lifted off the pouring tube and removed to a conveyor while at the same time an empty mold is moved into the pouring position on the pouring tube and the process is ready for the next pour. Thus, the pouring is continued automatically until 20 wheels have been cast.

After this the cover is removed



Finished cope, still warm, has spray coat of silica wash and stopper set in place.

Drag is merely wiped clean, repaired in stopper seat, and sprayed while still warm.

from the tank and the small quantity of steel remaining in the ladle is returned to the arc furnace which is already in the process of melting metal for the next pour.

Because of the high conductivity of a graphite mold, solidification occurs with astounding rapidity. In only five minutes the 700-lb casting is completely solidified and ready for removal from the mold. At this time, however, the rim riser sprues, because they repose in a small quantity of sand, are still in a pasty state. Consequently when the cope is lifted five minutes after pouring, the 1¼-in. risers remain in the cope.

Risers are Insulated

The three riser holes in the graphite cope are lined with ½ in. of core sand for the purpose of insulating the riser metal. The metal remains liquid long enough to insure proper feeding while the casting is rapidly solidifying in the graphite mold. After the cope is removed, the wheel with the stopper pipe protruding up out of the center of the hub riser, reposes on the drag until the conveyor moves to the next station one minute later.

When in this position, a specially designed overhead conveyor grips the stopper pipe, lifts the wheel out of the drag and transfers it to a monorail conveyor-type insulating tunnel. The tunnel keeps the wheel from cooling too rapidly while transferring it to another part of the shop for further processing.

The remainder of the process consists of removing the riser sprue stubs with a scarfing torch and cutting out the hub bore hole with a specially designed hub cutting oxy-acetylene torch machine. The oxy-acetylene hub cutting operation is novel in that the hollow stopper pipe, which remains in the solid hub after the wheel is cast, is used as a pilot hole for starting the cut. This eliminates the need for a costly oxy-acetylene lancing operation prior to the actual hub cutting.

After this follows a normalizing heat treatment at 1550 F to complete the job of producing the wheel. With the exception of machining the hub bore for axle mounting purpose, the casting is ready for shipment. No cleaning or other machining is required. However, for the sake of appearance, the wheels were shot blasted.

Although the principal object in the development of this process was the complete elimination of the use of molding sand, it was not entirely possible to accomplish this. A small amount of sand is still required as a lining for the riser holes and the Washburn core type knock-off pad at the bottom of the riser. Here again, however, a new method of placing this sand in the mold has been devised which takes advantage of the characteristics of phenolic bonding of core sand.

While the cope is still hot from the previous pour (approximately 600 F) and after the riser holes have been cleaned of old sand, it is placed on an electrically-heated plate which is machined to the cope contour. Riser forms are lowered into the holes and a mixture of 98 per cent pure silica sand and 2 per cent phenolic binder is poured around the forms.

Mold Close-up Preparation

Within approximately two or three minutes, the core sand mixture is properly baked from the heat of the hot plate on the bottom and the residual heat from the mold on the sides. After this period, the forms are withdrawn and the cope is removed. While still warm, it is sprayed with a thin coating of silica base wash. The cope is then rolled down a gravity conveyor to the close down area where, after the stopper is set, it is placed on a previously prepared drag.

Preparation of the drags involves wiping them clean, repairing any defects in the stopper seat, and spraying while still warm. They are then replaced on the conveyor and transferred to the close down area where the copes are applied.

To the best of our knowledge, this method of utilizing compressed air to cast steel railroad car wheels in graphite permanent molds is completely new and all phases of the process have been covered by patents.

National Founders to Hear Castings Use Panel

The Edgewater Beach Hotel, Chicago, will be the site of the 57th annual meeting of the National Foundry Association on Thursday and Friday, October 6 and 7. The Administrative Council Meeting and Alumni Dinner will be held the day before.

"Preparation for Arbitration: What the Arbitrator Would Like to See," will be the subject of Dr. Clarence M. Updegraff, professor of law, State University of Iowa.

Other highlights include *"The Outlook for Use of Castings," "Foremen in the Foundry,"* and *"The Recent Settlements in the Automobile Industry."*

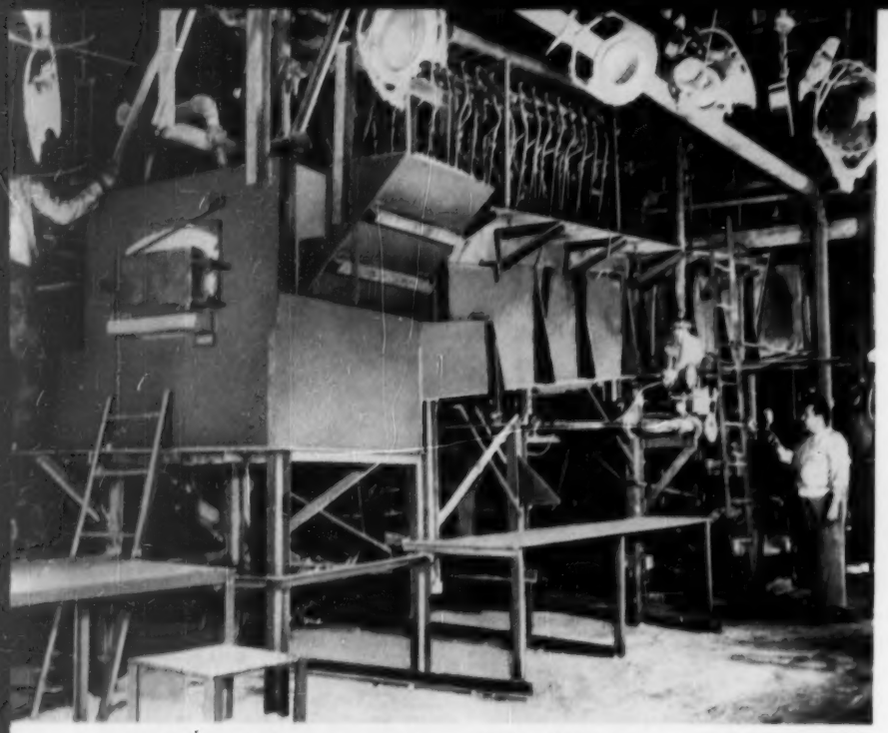
Will Stage Castings Clinic At Northwest Conference

Sand Technology will be featured at the Northwest Regional Foundry Conference in the afternoon half of an AFS Castings Clinic and in a separate presentation. Other program highlights include Clinic discussions on gating, casting design, and non-destructive testing, a luncheon address by R. W. deWeese, Electric Steel Foundry Co., entitled *"Frontiers of the Foundry Industry,"* a motion picture on foundry sand handling, and a talk on basic refractories followed by a refractory round table.

This year's Northwest Regional, under the general chairmanship of James Dorigan, Electric Steel Foundry Co., will be held October 14 and 15 at the Multnomah Hotel, Portland, Ore. Sponsors are the Oregon, Washington, and British Columbia Chapters of the American Foundrymen's Society, and the Oregon State College Student Chapter.

Program includes a banquet and dance the evening of October 14, and a special ladies program.

Hotel reservations and advance registration may be made through Bill Reilly, Federated Metals Div., American Smelting & Refining Co., 1900 NW 18th Ave., Portland, Ore. Conference fees (registration, two luncheons, banquet, dance and ladies, brunch) exclusive of hotel accommodations are: AFS member, $10; AFS member and wife, $14; non-member, $12; non-member and wife, $16.



Continuous furnace will melt from 1500 to 3000 lb/hr after a heat-up of only 3 hr with an over-all gas consumption of 1.9 cu ft per lb aluminum.

RADIANT HEAT FURNACE Feeds Metal Molds

New continuous melting method has many advantages: better quality; reduction of wasteful heating; solution to summer problems.

JOHN J. KEATING / *Vice Pres. Mfg. Monarch Aluminum Mfg. Co., Cleveland*

■ A new method of melting aluminum alloys for casting—the first in-line, continuous melting method in this field—is giving Monarch Aluminum Mfg. Co. superior working conditions, reduced foundry overheads and a closer control on metal handling and casting quality, at a substantial saving in fuel costs.

Monarch aluminum permanent mold castings and aluminum and zinc die castings are used as appliance and machinery components by many leading manufacturers. As part of a continuing program to improve the quality of these components and to stabilize production rates and control foundry costs, the company has long sought to eliminate inefficiencies in conventional melting and pouring methods.

They have solved this problem by developing an automatic continuous melting furnace which has eliminated wasteful heating of heavy furnace equipment and large reserves of molten aluminum.

The new furnace design employs radiant gas burners operating at high temperatures to effect fast, controlled heat transfer.

In its original conception, a relatively small tunnel furnace slopes downward (about 2 in. per ft in the units now in use) from the input to the output end. Ingots are loaded at the upper end, and automatically pushed lengthwise under a roof of radiant burners. The melting rate and the pouring temperature are controlled by regulating the speed of the ingots through the furnace and the fuel input to the burners.

Less Than 30 Min Melt Cycle

The molten aluminum flows continuously through an opening near the lower end of the furnace, directly into a pouring ladle. This cycle from cold ingot to liquid takes but 24 to 30 min. If the direct pour principle is not desirable from a production standpoint, alternate designs embodying a limited holding pot principle are readily adaptable.

Radiation heating, already used in the foundry field in batch melting of magnesium, curing shell molds, drying green sand molds, and other applications, was adapted to the continuous melting furnace. Natural gas and air are fed in accurately controlled proportions and under controlled pressure to the cup-shaped burners. The mixture is burned within each cup, heating the ceramic lining to incandescence.

Melting by Heat Radiation

Heat transfer between the cup and the aluminum charge is largely by radiation, bringing the aluminum quickly to the melting point.

Sixty burners, four rows of 15, are patterned to provide a radiant roof 10 ft long and 3 ft wide over the final ⅓ of ingot travel. Combustion products provide preheat during the first ⅔ of ingot travel, and may offer some atmosphere control.

Since there is no aluminum in the furnace in a fully liquid state except in the immediate vicinity of the pour point, there is little chance for the formation of oxides. Each ingot, however, is fed into the furnace already covered with an oxide coating. This coating does not melt, but is moved down to the lowest point of the furnace, outside of the operating region. The furnace operator can remove the collected oxide films from time to time, whenever convenient.

Operation of the continuous melting furnace is simple. Bringing the start-up charge to pouring temperature takes less than three hours. This compares favorably with the 22 hr required to start a conventional reverberatory furnace.

Once operating temperature is reached, charging rate is set to meet demand. Fuel flow is adjusted to achieve the desired pouring temperature as the oxide envelope is pierced. Four, five, or six ingots (depending on furnace size) are set on the charging table every five to 10 min, but the exact timing is not critical if suitable loading equipment is provided. The oxide can be removed from the lower end of the furnace two or three times a shift.

Automatic Casting

Once operation is stabilized, the production rate is easily controlled by adjusting the charging equipment. Pouring temperature is maintained automatically by controlling the burners through a thermocouple in the ladle or small holding pot.

Continuous, controlled output immediately suggests automatic casting, an advancement continuously developed by Monarch during the past 15 years through the design and installation of mechanical methods to bring the permanent molds past the pouring area of the furnaces.

Operation Flexibility

Quality control has proven to be one of the major advantages of the continuous melting furnace. Castings are of the same analysis as the ingots they are poured from and are reproducibly uniform from casting to casting. Intermediate alloys can be obtained by mixing ingots of different composition and, if desirable, of different size in the

same charge. Ingots weighing from 35 to 60 lb are used.

When one run ends, the alloy can be changed to meet the requirements of the next run while the furnace is still in operation. This simply calls for anticipating the change, and loading ingots to meet the new specifications in time for them to reach the pouring stage as the new molds are placed in service. Alloy can be changed several times in a single shift, if necessary, while maintaining nearly full production.

Aside from analysis, the general quality of the castings has been improved significantly. The short heat cycle, for instance, does not hold the aluminum liquid long enough for much dross to form. For this reason, too, there is practically no gas absorption. The grain structure in test castings shows greater uniformity, also, although no exact correlation has been established.

Eliminates Summer Slump

One advantage of the continuous melting furnace is obvious in every department of the plant. This is the elimination of the summer drop in production due to high temperatures in the working areas of the casting room. With conventional reverberatory furnaces, or large holding pot operations, heating of the air space around the furnaces becomes a serious problem during the summer months. On hot days, men are frequently forced to stop work after only three or four hours of work, and lack of output in the foundry means lack of work in finishing and other departments. As a result, large numbers of employees leave the company every summer, and new crews must be trained each fall, despite generally good working conditions and relations in other respects.

With the continuous melting furnaces, the combined problem of low production and large labor turnover has been solved right at the source. The outside surface of the furnace wall is cool to the touch, and there is no need for holding large quantities of aluminum at or near pouring temperature.

The lowest point of the furnace itself is about 4 ft above the floor, and further elevation of the furnace is entirely practical. Its light weight and small size make possible the suspension of the complete furnace from ceiling structure or a few vertical columns, permitting use of the entire floor space as working area or for other equipment, and further reducing the space heating effect.

In addition to the actual reduction in costs, continuous melting provides a much closer control of these costs. The direct costs of melting aluminum become very nearly proportional to the weight melted. Small furnaces for low production rates become practical, and it is economical to start up a furnace of any size even for a short run.

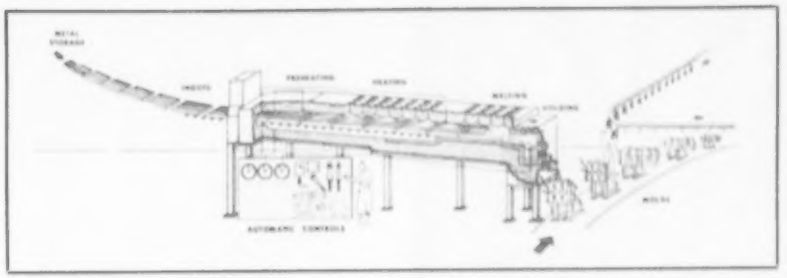
Part of the economy and flexibility of continuous melting lies in the small quantity of aluminum in process. Consider a 2000 lb/hr pouring rate, for instance. In the continuous melting furnace, only 1000 lb of aluminum is being processed at any one time, with only a few hundred pounds of it actually molten. To meet the same production with conventional reverbatory furnaces, on the other hand, about 15,000 lb of aluminum must be held in a liquid state at all times.

3-hr Heat Up

These new furnaces can be shut down within a matter of minutes with only a few pounds of metal to pour off and a minimum of oxides to remove. There is no need to hold at heat for prolonged periods. The furnace can be restarted and up to pouring temperature in less than an hour under many circumstances when a production delay occurs.

Operated for two 8 to 10-hr shifts, the furnace can be closed down during third shift mold maintenance periods and refired to melting temperature in a maximum of three hours before the start of the first shift the next day. This period is dependent upon the design of the furnace and the heating capacity of the fire brick.

As a result of eliminating the large liquid reserve, as well as the greater control of heating, fuel consumption is greatly reduced.



Melting rate and pouring temperature are controlled by regulating the speed of ingot travel and the fuel input to the 60 radiant roof burners.

Performance records at Monarch show an overall gas consumption of 1.9 cu ft/lb of aluminum melted in the continuous melting furnace as against 3 cu ft/lb in the most efficient reverberatory bath furnace. Deducting fuel requirements for the warm-up period, the ratio falls to 1.1 cu ft of gas per pound melted compared to approximately 1.7 cu ft lb, best of publicized figures for the other furnaces.

Monarch is using three continuous melting furnaces in the permanent mold casting room, with capacities of 1500, 1800, and 2400 lb/hr, rated at 1400 F pouring temperature. They have been operated at rated capacity, and at as little as 60 per cent of capacity without any appreciable decrease in efficiency. Apparently each furnace could be operated at a greater degree of turn-down without increasing unit costs.

In operating these furnaces, as a matter of fact, the company has turned up no evidence that would indicate any limit to building similar furnaces in much smaller or much larger capacities.

The ultimate conversion of all batch type furnaces to several versions of continuous melt furnaces is thoroughly planned in Monarch's permanent mold foundry. Timing will depend upon the life expectancy of present equipment. Designs are being prepared for furnaces embodying the continuous melt principle for effective use in the die casting department.

Ingots loaded at the upper end of the continuous melting furnace are automatically pushed lengthwise under a roof of radiant gas burners.

Fig. 1 . . Jet engine housing.

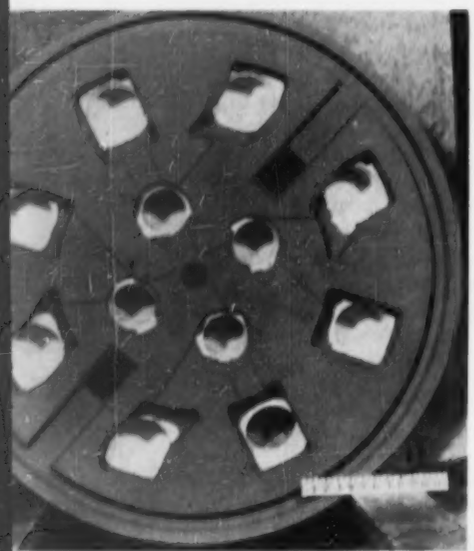


Fig. 2 . . Riser sleeves and gates.

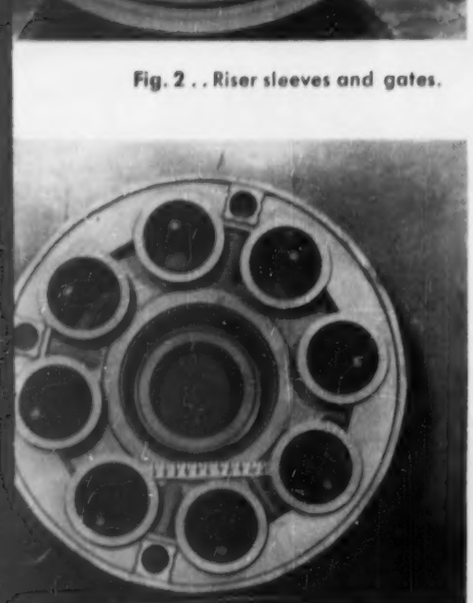


Fig. 3 . . Drag side of housing.

Make SMALL RISERS Do the Work of LARGE

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Shrinkage and porosity have always been problems in sand casting of aluminum. Insulating and exothermic risering and padding materials can give higher yield and better quality

■ Shrinkage porosity is one of the greatest problems in the production of aluminum sand castings. It results from the change in volume that occurs when the metal or alloy being cast goes from the liquid to the solid state.

All sand castings tend to contain shrinkage porosity to some extent although it may be of microscopic nature. However, as Walther, Adams, and Taylor[1] have indicated, shrinkage porosity is one of the principal reasons why sand castings tend to have lower mechanical properties than wrought products. If he wishes to maintain casting sales or expand against encroaching competition from wrought products, the foundryman must apply methods to reduce shrinkage porosity in the castings he produces.

■ **Shrinkage and Feeding.** In the production of high quality sand castings it is required that the metal in the mold start to solidify at points remote from the risers or feeders. Solidification must proceed continuously toward the risers or feeders, which must be the last to solidify, all shrinkage being retained in them, while the casting itself is sound. This has been termed *directional solidification*. When the foundryman, through the application of various expedients can control the thermal gradients in a solidifying casting in such a manner as to produce directional solidification, he has obtained *controlled directional solidification*, and has eliminated shrinkage in his casting.

According to Ruddle[2] the principal devices for obtaining directional solidification are:

1. Gating and feeding methods capable of setting up favorable temperature gradients during pouring.
2. Favorable pouring rates and temperatures.
3. Padding.
4. Chills.
5. Mold materials of different thermal properties for various parts of the mold.
6. Optimum feeder positioning and design and the use of feeding compounds.

A 6 to 8 per cent reduction in volume takes place during the cooling of aluminum alloys from an average pouring temperature to their freezing point. Theoretically, a riser volume slightly greater than 6 to 8 per cent of the casting volume should be sufficient to feed an aluminum casting. However, the foundryman knows from practical experience that such a riser volume, using conventional risers, is entirely inadequate and unsound castings would result.

The foundryman generally measures riser efficiency in terms of per cent casting yield. He divides the weight of the finished casting by the weight of metal poured to produce the casting (includes rough casting, gates, and risers) and multiples by 100.

Casting yield for aluminum castings using conventional risers averages about 40 per cent. Even at these low yields, shrinkage porosity is seldom completely eliminated. Therefore, the foundryman must increase the efficiency of his risers in order to obtain controlled directional solidification and reduce shrinkage.

■ **Increasing Riser Efficiency.**

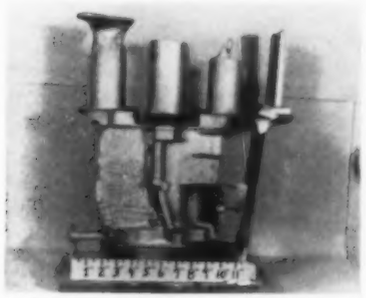

Fig. 4 . . Fuel pump body with insulated risers, bottom gating.

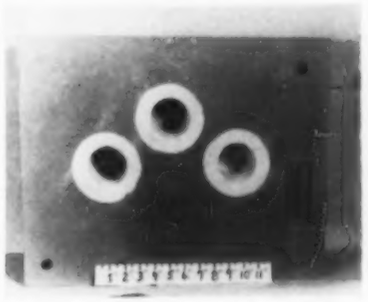

Fig. 5 . . Plaster riser sleeves are jolt rammed-up in coremaking.

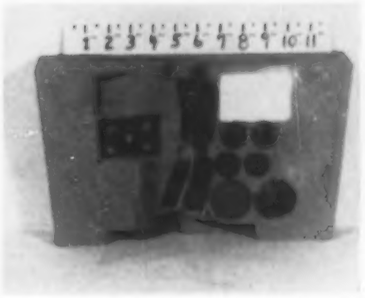

Fig. 6 . . Plaster pad and chills secure controlled solidification.

Proper location of risers on the casting is the first step necessary to promote riser efficiency. Riser location depends principally on the casting design and risers must generally be located on the heaviest sections of the castings. In some cases padding (adding stock to thin sections) is necessary so risers may be positioned to secure directional solidification.

Proper dimensioning of the risers is the next step in securing riser efficiency. The preferred shape for the risers is a cylinder because it minimizes heat losses and is easily molded. A common riser height for cylindrical risers molded in sand is 2 to 3 times the diameter of the riser. However, if heat loss by radiation from the top surface of the riser and by conduction from the walls of the riser is reduced by insulation or addition of heat, riser height can be equal to or only slightly greater than riser diameter. Caine[3, 4] summarizes the design of risers and develops formulas for calculating riser dimensions.

Riser efficiency may be increased by the use of sleeves made of insulating material to surround the riser and by covering the riser with insulation to reduce heat losses as shown by O'Keefe.[5] If heat losses are reduced by these methods the risers will stay liquid longer and smaller risers can do the job of the larger conventional risers, thus increasing casting yield. In addition, an adequate reservoir in the risers aids in maintaining positive feeding pressure and promotes directional solidification, thus assuring the production of sound castings.

▪ **Gypsum Riser Sleeves.** Use of gypsum insulating sleeves to reduce heat losses and increase the efficiency of risers was first discussed by Taylor and Wick,[6] particularly as applied to bronze castings. The gypsum plaster used by Taylor and Wick had disadvantages due to its low permeability since even small amounts of moisture present in the plaster sleeve were converted to steam and caused blow holes in the casting. The sleeves were also quite fragile and difficult to set in the mold.

More recently, a highly permeable gypsum plaster was developed and has been discussed by Miericke and Johnson.[7] The new plaster is stronger and eliminates the blow hole problem. Also, it has greater insulating properties due to the large number of dead air spaces incorporated in the plaster. Methods for making sleeves from the permeable plaster have been discussed by Miericke[8] and further information is available in commercial literature.

To produce permeable gypsum sleeves, the special plaster is mixed with water in the proportion of 100 parts to 80 parts water by weight. A special disc impeller attached to a high speed drill is recommended for mixing. The disc should be 4 to 6 in. in diameter and made of rubber about ⅛ in. thick. The high speed disc is inserted at such a level in the plaster-water slurry that air bubbles are entrained in the slurry by the disc rotation until the volume of the slurry is increased 50 to 70 per cent by the foaming action.

The foamed slurry is poured into a suitable core box and allowed to take an initial set for 15 to 25 min. At the end of this period, the sleeve is extracted from the core box, placed in an oven, and dried at 250 to 500 F. The lower drying temperatures are preferable because higher strengths are obtainable, but the drying temperatures are also dependent on air circulation, velocity, and humidity.

Core box equipment may be made from wood, metal, plastic, or rubber. Rigid patterns should be coated with suitable parting compounds. Control over the insulating properties of the sleeves is maintained by controlling the percentage volume increase of the slurry, the wet weight, and the AFS dry permeability.

The permeable gypsum plaster insulating sleeves were applied very successfully to the production of bronze castings. Higher yields and consistently sound castings were obtained. The availability of a commercial source of satisfactory permeable gypsum plaster insulating sleeves promotes the use of the sleeves since a steady supply of satisfactory sleeves can be obtained at reasonable prices.

Some foundries may find it advantageous to buy their insulating sleeves from a supplier instead of making them because this saves cost of equipment, necessary experience in production, personnel, etc. Successful application of the permeable gypsum plaster risers to bronze castings encouraged consideration of their use on aluminum castings and they were applied successfully as shown on the following examples. All sleeves used in these castings were purchased from a commercial source.

Figure 1 shows the gating and riser system on a complicated 194-lb 355-T51 aluminum alloy housing for a jet engine. Stringent quality requirements for this casting include pressure test, 100 per cent x-ray inspection, fluorescent penetrant, and dye penetrant inspections. No welding is permitted in certain critical areas, and only limited welding permitted in other areas.

Twenty permeable gypsum plaster insulating sleeves are used in this casting: eight open top 3½-in. ID, 8-in. high sleeves to feed four heavy pads on the outside wall of the casting; seven blind top and one open top 4½ in. ID 6 in. high sleeves to feed the outer and middle flanges; and four blind top 3½ in. ID 8 in. high sleeves to feed the center flanges.

Most of the risers were made blind by extending the gypsum

Fig. 7 . . Stringent quality requirements of jet engine fuel pump housing were met with a thoroughly chilled drag and permeable plaster riser sleeves. Fig. 8 (right) . . Close-set sleeves were made in altered box.

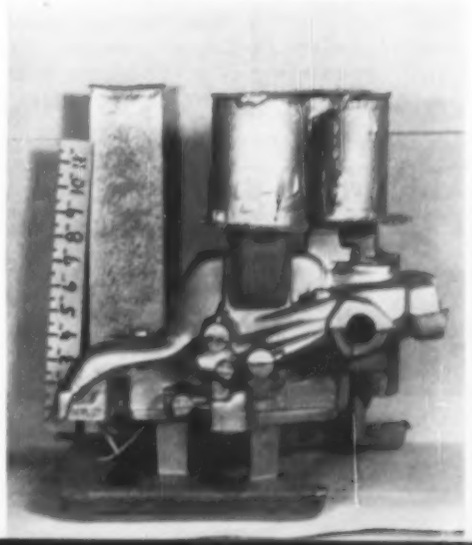

Fig. 9 . . Shrink-free, 110-lb. bearing is machined all over.

Fig. 10 . . Bearing drag pattern shows top gating through risers.

Fig. 11 . . Pattern pads locate riser sleeves during ram-up.

sleeves to cover the tops of the risers in order to insulate the tops of the risers, reduce radiation losses, prevent sand falling into the risers during and after assembly, and to prevent accidental spilling of metal down the risers during pouring. The open risers are covered with insulating material after the casting has been poured.

Although it was necessary to gate this casting at the bottom of the mold cavity, favorable thermal gradients and controlled directional solidification are obtained by the employment of the insulating sleeves, thorough chilling of the drag side of the casting and heavy section, and the application of a secondary gating system that is used to fill the risers with hot metal as soon as the mold cavity is filled above the casting level.

Figure 2 shows the large dry sand core containing the insulated risers and secondary gating channels for riser feed. Riser plugs slightly larger in diameter than the riser sleeves are placed in the proper locations in the core box, the core is rammed up, the plugs withdrawn and sleeves substituted. Sand is then tucked around the sleeves, the core struck off and drawn from the box. The core is baked with the riser sleeves in place. Figure 3 shows the drag side of the casting, the cross-hatched marks on the casting indicating chill locations.

The pouring weight of this casting is 538 lb which gives a casting yield of 36 per cent. While this is a relatively low yield for a casting made with insulated risers, the principal emphasis has been placed on securing a completely sound casting without attempting to secure high yield.

The various other operations necessary to produce this casting are also closely controlled. Result is extremely low scrap loss on this job on more than 5000 castings produced. One customer has rejected a single casting from a run of 1200.

It is estimated that if conventional risers were used, the yield would be about 20 per cent with possibly much higher scrap losses.

Figure 4 is a jet engine fuel pump body cast in 355-T71 alloy. The quality requirements on this casting include 100 per cent x-ray inspection, pressure test up to 1000 psi, complete freedom from pinhole porosity, absolutely no shrinkage, and restricted welding. Some of the sections in this casting are 2½ in. thick.

The core containing the three 2½ in. ID, 6-in. high permeable gypsum insulating sleeves is illustrated in Fig. 5. One of the three sleeves has an open top; the rest of the risers have blind tops for the reasons stated for the previous example. This core is made on a jolt-roll-over machine and the sleeves are rammed directly in place in the core box without breaking.

This casting is particularly interesting since the heavy 2½-in. thick body section is fed by risers attached to a thinner 1 to 1½-in. thick flange even though the casting was bottom gated. Directional solidification was secured by thorough chilling of the drag and heavy sections and the use of insulated risers and an insulating pad.

Figure 6 shows a 3x2 in., 1-in. thick gypsum insulating pad that was placed under a riser and against the thin section above the heavier body section. The body section is chilled with progressively lighter chills up to the padded section. This assures a favorable thermal gradient, from drag section to riser. The riser on the left in Fig. 4 is directly above the padded section. Placing of the risers in other locations on the casting would have been impractical.

The pouring weight of this casting was 38 lb and shipped weight was 21 lb, giving a casting yield of 55.5 per cent. A low rejection rate was obtained by the use of the methods described above.

Figure 7 shows the housing used on the fuel pump body in the preceding example. It must meet the same stringent quality requirements. Bottom gating is used (Fig. 10), two open top 3½-in. ID, 5-in. high permeable gypsum plaster riser sleeves are used to feed the casting, and the drag is thoroughly chilled to secure directional solidification.

After the casting is poured, the tops of the risers are covered with insulating compound. Figure 8 shows the two insulating sleeves in the cope core. The sleeves had to fit close together so inserts were placed in the sleeve core boxes to reduce the thickness of one segment of each sleeve wall.

The pouring weight of this casting was 36 lb and the shipping weight was 20 lb; casting yield was 55.0 per cent. An especially low rejection rate was incurred.

The 355-T51 aluminum bearing illustrated in Fig. 9 has a shipping weight of 110 lb. It is machined all over and has a bearing raceway cut completely around the outside wall. It must be completely free of shrinkage porosity.

Figure 10 shows the drag pattern complete with runner and gates. The gates enter the casting flange at the base of the risers thus promoting directional solidification.

The cope pattern for this casting (Fig. 11) shows the location of the riser pads that position the eight 2½-in. ID, 8-in. high insulating sleeves while the cope mold is being rammed.

The pouring weight of this casting is 220 lb; yield is 50.0 per cent. This usually difficult casting is produced easily with a low rejection rate using the above methods.

Higher casting yields may be obtained on less critical castings by using riser sleeves whose height has been reduced to approach the ID of the riser sleeve. It should be recognized that the combination of intelligent use of chills with the use of insulated risers, as discussed in the preceding examples, greatly aids in producing sound castings.

Perlite Riser Sleeves. Boyle and Wolfer[10] have discussed the use of perlite as a material for insulating sleeves. This mineral is a siliceous or acid lava containing 2 to 5 per cent water still in solution in the rock. When heated quickly to 1600 to 2000 F, perlite expands, each particle becoming a bubble of low density and high strength. The expanded perlite, an excellent insulating material, can be used to make insulating sleeves or as an insulating cover for the tops of risers.

Sodium silicate is a suitable binder because it does not appreciably detract from the insulating properties of the perlite. The perlite-sodi-

COMPARISON OF RISER SLEEVE MATERIALS

	Expanded Perlite	Permeable Gypsum	Exothermic Material
Cost	A	B	C
Thermal Efficiency	C	B	A
Gas Contamination	A	A	C
Sand Contamination	A	B	C
Metal Contamination	A	A	C
Ease of Manufacture	B	C	A
Ease of Application	A	A	B

A, best; B, fair; C, poorest.

um silicate mixture may be prepared in a sand muller. The mixture can be rammed into sleeves in a suitable core box and then dried at a high enough temperature to set the sodium silicate. Sleeves are also produced by a commercial source.

A cooling rate test has been made comparing the cooling rates of 355 alloy cast in 1½-in. ID, 6-in. high risers surrounded by green sand. Chromel-alumel thermocouples were inserted into each riser opening to a uniform depth of 4 in., connected to a multi-point recording pyrometer and aluminum poured simultaneously into each riser (Fig. 12). The tops of the risers were insulated with 1 in. of expanded perlite immediately after pouring. The cooling curves obtained are shown in Fig. 13.

It will be noted that the cooling rate of the riser cast in the expanded perlite sleeve was such that it reached the freezing range about 11 min after the riser cast in green sand reached the freezing range. The riser cast in the gypsum insulating sleeve reached the freezing range 3 min after the riser cast in the expanded perlite sleeve.

Since the perlite sleeves show insulating properties almost equal to the gypsum sleeves, it has been found possible, in some cases, to substitute perlite sleeves for gypsum sleeves in the foundry. The perlite sleeves generally prove somewhat cheaper since they can be produced faster than the gypsum sleeves. They are definitely not quite as efficient insulators as the gypsum sleeves.

▪ **Exothermic sleeves.** Exothermic mixtures have been developed that can be used to produce exothermic sleeves, pads, and knock-off cores. Such a mixture contains aluminum chips, an oxidizing agent such as sodium nitrate, a triggering agent such as magnesium chips, a filler such as sand to control the rate of the reaction, and a binding agent so the mixture is moldable.

The mixture is shipped ready to use with addition of water and may be mixed in a sand muller. The moistened mixture is rammed in a suitable core box and after withdrawal from the core box, the sleeve is baked at 400 F for about 2 hr. Care must be taken not to exceed this temperature or the mixture may ignite prematurely. The core should be thoroughly vented from the top of the sleeve and around the periphery to a depth of about 1 in. from the bottom of the sleeve. This is necessary to release gas formed by the exothermic reaction. Sleeve wall thicknesses may be thinner than those of comparable gypsum or perlite sleeves because of the better thermal efficiency of the exothermic sleeves.

The cooling curve for a riser cast in a sleeve made from such an exothermic material indicates that the temperature of the metal in the riser may actually increase after pouring due to the liberation of heat from the exothermic reaction touched off by the molten metal poured into the sleeve. The riser then cools at a considerably slower rate than risers cast in gypsum.

The riser cast in an exothermic sleeve (Fig. 13) reached the freezing zone approximately 10 min after the riser cast in the gypsum sleeve. Thus, the exothermic risers are considerably more efficient thermally than the riser sleeves.

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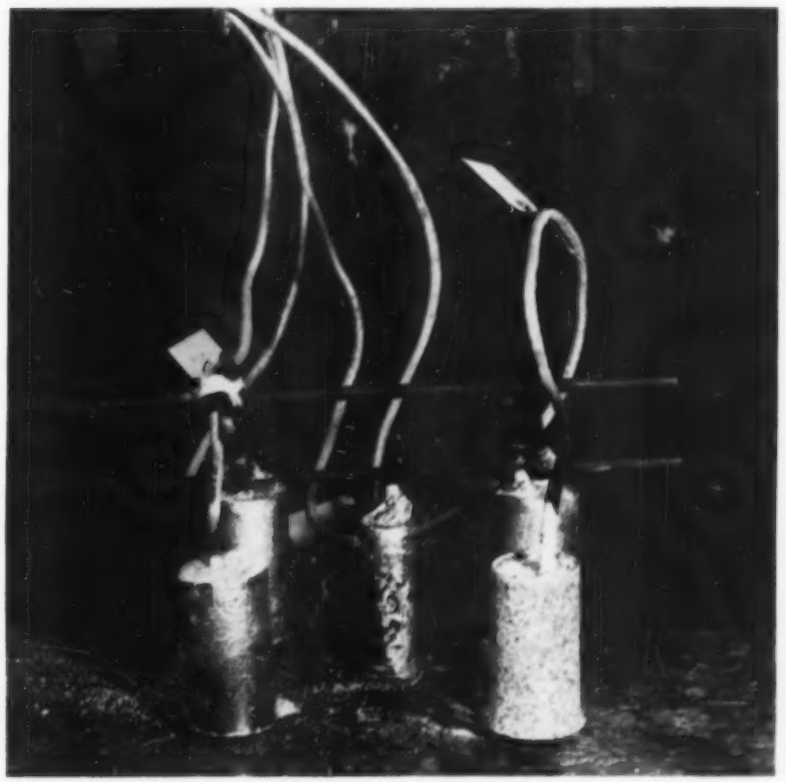


Fig. 12 . . Castings used in testing cooling rate of riser sleeve materials on 1½ in. ID, 6 in high risers of 355 aluminum alloy.

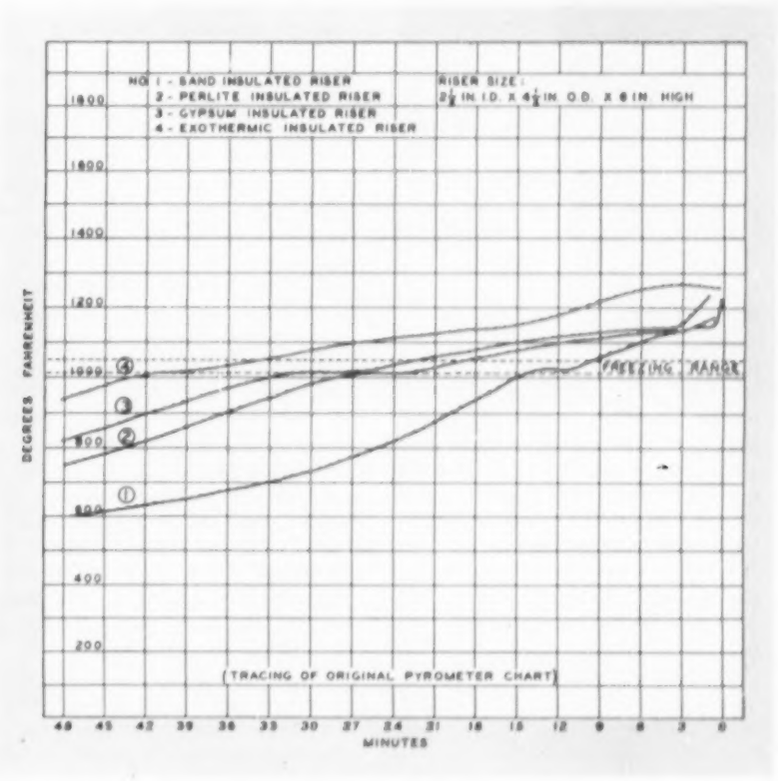
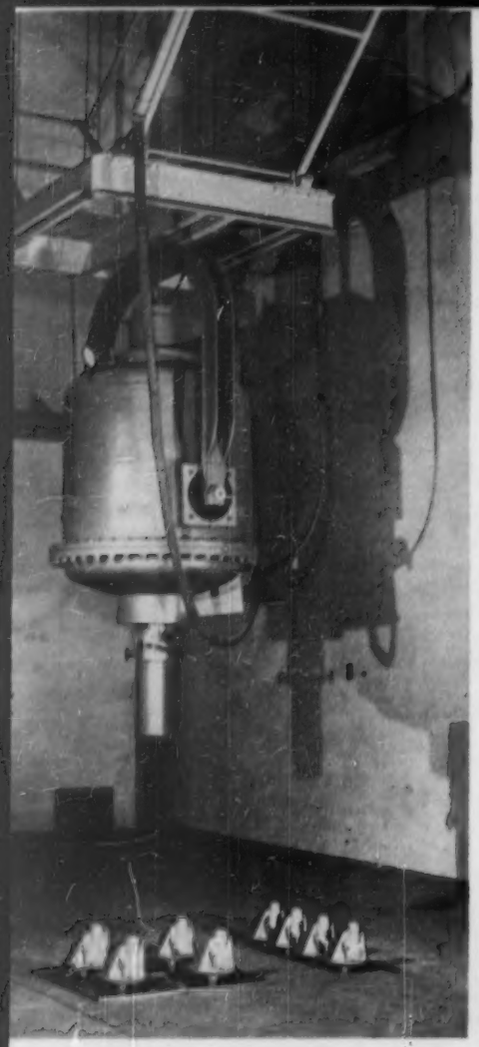


Fig. 13 . . Because perlite is almost as effective as gypsum and is cheaper to make into sleeves, it is sometimes used as a substitute



X-ray non-destructively tests malleable iron differential housing castings for core blows.

CORE ROOM PITFALLS

Cores are worthless if they don't produce good castings. It's high time core room supervision realized this fact

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■ Core costs can generally be reduced in most core rooms. Often the direct result will be a better core, one that will do a better job in the foundry. It should be the goal of all core departments to produce a core that aids in making quality castings rather than to produce a core merely to overcome certain core room problems.

For a core to have green strength, hot strength, baked strength, and collapsibility very close production control must be maintained. This can be done only with the aid of qualified supervision and proper control of materials used in the core sand mixtures.

Above all, raw materials must be uniform in quality. They must consistently impart the same physical properties to a given core sand mixture. It is here that supervision has a very definite and important responsibility to management when determining raw material sources. They must establish sources which are dependable and produce a product which is consistently uniform in quality with delivery guaranteed at a price in conformity with competitive sources.

When raw material sources have been established it then becomes the responsibility of supervision to establish correct and uniform core sand mixtures which will produce cores of desired uniform physical properties. If this end is to be attained supervision must insist on correct minimum weights or volumes of all raw materials used to produce a given core sand mixture.

Supervisors must know the weight of the base sand being used, the amount of cereal necessary for proper green strength. They must know the proper volume of water necessary for proper activation of the cereal, the amount of oil necessary for correct baked and hot strength as well as for proper collapsibility. Supervision must also be certain they have the proper mulling cycle, a cycle which will develop the maximum physical characteristics of the core sand.

Once a proper core is developed and proven to be satisfactory, uniformity and ability to reproduce the same mixture are of primary importance. Once a given core sand mixture is established no change should be made without the approval of all concerned.

Many instances may be cited where a particular casting which has been produced successfully in the foundry over a period of time suddenly becomes a constant source of scrap. Frequently, it is found that the core is at fault.

The core may have become too soft resulting in the gates washing or in a general condition of washing causing excessive metal on the cored surface of the casting. The casting may be showing evidence of hot tearing due to the core not having sufficient collapsibility during the solidification of the molten metal. The scrap increase may be the result of excessive core gas.

The cause of these sources of scrap may be core room supervision who, without any consideration for the foundry or not realizing the effect on core characteristics, have changed core sand mixtures to overcome a particular problem in their department. Perhaps increased oven capacity was required to meet production commitments and it appeared expedient to shorten baking cycles by reducing oil content. Not recognized was the fact that a softer core would cause foundry scrap.

Oil may have been added to the core sand mixture to overcome a handling problem in the core room. The increase may have produced a core with collapsibility decreased to the point where hot tearing occurred. Or gas content may have increased, resulting in gas holes. The cereal in the core mixture may have been increased to produce a core with greater green strength.

Again, it must be emphasized that no change in an established core sand mixture—one proven to be successful—should be allowed without complete knowledge of the effect of the change on the casting. If only core room supervision would realize that the cores they are producing have absolutely no material value . . . that by themselves are completely worthless until they are used to produce a casting . . . that it is the casting not the core which is the end product . . . they would be more careful about making changes in core sand mixtures which would affect the characteristics of the core and in turn affect the quality of the casting.

Considerable thought and effort must be given to the establishment of a new core sand mixture if the cores to be produced are to promote production of a quality casting. Core room supervision must have complete knowledge of the function of the core in relation to the casting before an intelligent approach can be made to the development of a practical and economical core sand mixture. The following points must be carefully considered:

■ 1. Will the position of the core in the mold promote washing? If so, evaluate oil ratios carefully.

■ 2. Must the core have exceptionally good collapsibility due to variation in casting wall thickness? It may be necessary to sacrifice casting smoothness on the cored surface to prevent hot tearing of the casting. Here cereal and oil ratios must be evaluated carefully.

■ 3. What finish is required of the cored surface? This will partly determine the fineness of the base sand used to make the core.

■ 4. What function does the core serve in the mold? Is it to be used as a ram-up core, as a ring core to position another core, or perhaps as a gate or skimmer core?

Knowing the correct answers to these questions will aid core room supervision in making a good, practical, economical core.

Development of an economical core sand mixture requires considerable effort on the part of core room supervision and is not as easily accomplished as might be expected. An economical core sand mixture frequently requires careful handling of the core. How convenient it becomes to increase the cereal content of the core sand rather

than insisting that coremakers handle their core boxes carefully or that cores be carefully transported to the baking ovens. Perhaps the oil content of a core sand is increased only to make handling of the baked core less of a problem.

In either case not only has the cost of the core been increased, but supervision has shown laxity by not insisting that personnel do their jobs correctly. Neither have they considered the effect of the increased raw materials in the core on the casting to be made from these cores.

The most economical approach to the development of any core sand mixture is to consider that any material added to the mixture—other than sand—is detrimental. The proper approach then is to add only that amount of material which is necessary to produce a casting free of defects attributable to the core.

If it were not necessary for a green core to have strength to prevent sagging prior to baking, green binders would not be necessary. Therefore, the minimum amount of these materials should be incorporated in any core sand mixture. The same reasoning applies to core oil. Only that amount of oil should be added to prevent washing of the core as the core comes in contact with molten metal. Additional oil not only increases the cost of the casting but excessive oil promotes foundry problems such as hot tearing and blows.

Lean oil ratios of one part oil to 250 parts of sand, although uncommon, are in many cases certainly practical. An example is the body core used to produce the 50-lb malleable casting illustrated. Although the pouring temperature of the metal is 2750 F, there is no evidence of metal penetration.

Collapsibility of the core is exceptionally good and there is no evidence of hot tearing or excessive core gas. The core is especially soft and as a result must be handled carefully from the time it is produced until it is placed in the mold. It does, however, serve its purpose very well—that of producing a quality casting with a minimum of scrap due to the core.

Another example of lean oil ratios is shown in the core made with an oil to sand ratio of one to 500. The casting shown with the core is particularly susceptible to hot tearing in the thinner sections. The body core shown has good collapsibility and eliminates any tendency to hot tear without the addition of cracking strips.

There is a slight sacrifice in cored surface finish but it is felt that it is more important to produce a metallurgically sound casting—one which during solidification meets a minimum of resistance to contraction.

Selecting Raw Materials. It must be realized that the physical properties of a core are the result of the properties of the component parts of the core sand mixture. Therefore, the selection of raw materials is very important. The selection of a proper base sand frequently presents a problem. It may generally be said that satisfactory sands should have rounded grains.

Sands should be comparatively free of clay. Clay in core sand mixtures lowers permeability and requires additional oil to maintain a given baked strength, resulting in increased gas content evolution.

Surface finish required on the cored surface will determine the fineness or coarseness of the sand used. Less foundry trouble will be experienced in the casting of malleable iron with the coarser core sands. Cores made with coarser sands will naturally require less oil, will bake out more rapidly, and will have better collapsibility. Select that sand having the largest grain size which will produce a satisfactory finish on the casting.

Selection of a good core oil should be considered very carefully. Here, foundries are dependent upon core oil suppliers to furnish a uniform product. Chemically it is impossible for the average foundry laboratory to analyze correctly a sample of today's core oils. However, there are certain basic physical properties which core oils impart to core sands such as baked strength, baking time, gas content, etc., which can be determined. These tests should be made periodically to insure a uniform product.

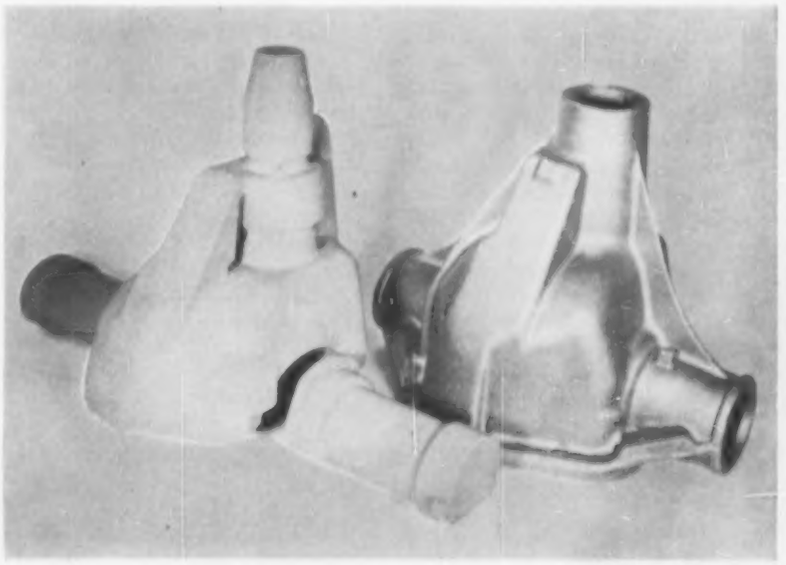
The characteristics of a given cereal binder, such as the ability to absorb water, as well as the dextrine content, should be noted carefully. Cereals containing higher percentages of dextrine produce harder cores with very good collapsibility.

It cannot be stressed too emphatically that the establishment of reliable sources for raw materials is essential if a good quality product is to be made day after day.

Core Scrap Control. Many core room departments do not have a well planned, properly executed core scrap program aimed toward the reduction of core scrap. This is essential if efficiency is to be increased and costs are to be lowered. Any program, large or small, will definitely aid in becoming more efficient.

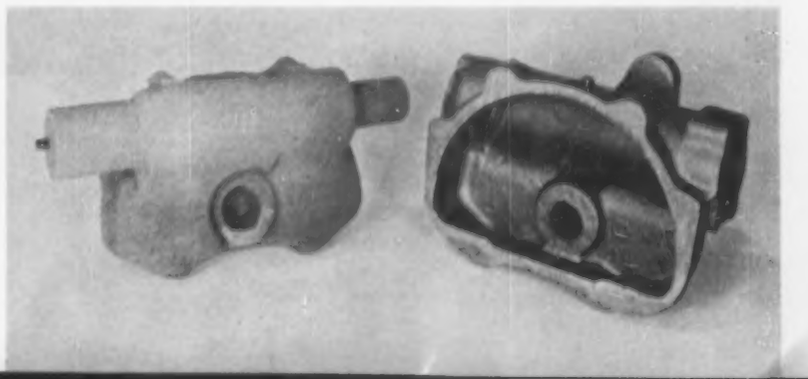
A core scrap control program must begin in the core sand mixing department; if we are to make good cores with a minimum of scrap we must be certain that all core sand mixtures meet specific requirements. The only approach to positive control is a sand testing program. Sand control will not only aid in reducing scrap cores but will also help in production of quality castings by maintaining uniform core properties.

Other factors which must be watched and controlled are proper venting of core boxes, keeping vents clean, carelessness on part of core makers, core baking time, etc. One approach to reducing core scrap is to develop a daily scrap chart of all cores made each day. With such a chart, core room supervision will be in a better position to take specific action on specific jobs and will definitely know from day to day how much improvement is being made toward the reduction of their core scrap.



Fifty-pound malleable casting was made with a lean oil ratio core from a mix of 1 qt oil to 500 lb lake sand, plus 5 lb cereal and 2.2% water.

Although the 1:500 oil-sand ratio sacrificed finish, good collapsibility allowed this hot tearing casting to be made without cracking strips.



Floor plans get thorough going over by (left to right) Wm. W. Maloney, AFS general manager, Wm. N. Davis, AFS exhibits manager, W. Stetson, Atlantic City Convention Bureau, and A. B. Sinnett, AFS assistant secretary.

Plan CASTINGS CONGRESS

■ "The Foundry of Tomorrow" will be the theme of the 60th Annul Castings Congress and Exhibit of the American Foundrymen's Society May 3 to May 9, 1956, in Atlantic City, N. J.

"New developments in machinery and processes make this Castings Congress the most exciting that has ever been held," according to William N. Davis, exhibits manager. "Many of these machines and processes are being withheld from public announcement until the Congress. Others are advancing from development into production stages right now and they will have a vast effect upon the industry. Every foundryman will be interested in seeing these new developments," he explained.

Machinery and process demonstrations will fill the huge convention hall at Atlantic City, largest in the world.

Officials of AFS held two midsummer meetings in planning the Congress, which is expected to attract more than 12,000 foundrymen from all over the world.

A meeting July 8 at the Morrison Hotel resulted in minor revisions of rules and regulations for exhibitors. A revised exhibitors' brochure is being prepared for mailing in September. Another meeting July 11 and 12 in Atlantic City established many details of the Congress.

The convention hall will be open from 9 am to 5:30 pm each day from Thursday, May 3, through Wednesday, May 9, with two exceptions:

- The hall will be closed all day Sunday.
- It will be closed from noon to 2 pm on Saturday for the annual Hoyt Memorial Lecture. It has been announced that S. C. Massari, former technical director of the American Foundrymen's Society, will be the Hoyt Lecturer in 1956.

Preliminary plans call for all technical sessions to be in meeting rooms of the convention hall itself. It is tentatively planned to conduct a maximum of four technical sessions at one time so that no more than four meeting rooms will be necessary.

Saturday will be East Coast Day —with admission free to all plant personnel from Eastern foundries.

The technical sessions have been planned in fairly complete form. Tours, women's programs and social affairs are also in an advanced planning stage.

One innovation for 1956 consists of plans to supply a daily attendance list to all exhibitors.

Other special features planned by H. J. Heine, AFS technical dir include:

- Symposium on Metallogr Leading metallographers will ticipate in a discussion of the of metallography to the fou man. Both ferrous and non-fe metallography will be cover well as machinability, prop judged by microstructure, an like.
- An AFS Research Exhibit be set up at the Congress in all divisions and committees soring research will participa
- A Management Dinner wi sponsored by the Safety, Hy and Air Pollution Control mittee to feature communit lations.

Castings Congress rules and regulations for 1956 were set up at meeting attended by (clockwise starting left foreground): G. E. Seavoy, Whiting Corp.; L. L. Andrus, Wheelabrator Corp.; R. L. McIlvaine, National Engineering Co.; Wm. W. Maloney, AFS general manager; J. S. Parker, Spo, Inc.; L. H. Heyl, Federal Foundry Supply Co.; Wm. N. Davis, AFS exhibits manager; B. L. Simpson, AFS national president; C. V. Nass, Beardsley & Piper Div., Pettibone Mulliken Corp.; V. F. Stine, Pangborn Corp.; J. M. Kane, American Air Filter Co.; W. R. Ferguson, International Nickel Co.; R. Matthews, Bakelite Co.; and A. B. Sinnett, AFS assistant secretary.

Appoint AFS Officials

Executive Committee me recently elected by the direct the American Foundrymen's ty are Thomas Kaveny, Jr., man Pneumatic Machine Co., burgh, Pa., C. V. Nass, Beards Piper Div., Pettibone Mu Corp., Chicago, and L. H. Du Dixie Bronze Co., Birming Ala. Other members of the co tee are Bruce L. Simpson, Nat Engineering Co., Chicago, president, Frank E. Shipley, pillar Tractor Co., Peoria, Ill. vice-president, and Frank J. Sterling Foundry Co., Wellin Ohio, immediate past preside the society.

Regional vice-presidents n for 1955-56 are Messrs. Ka Nass, and Durdin, Martin J. I Oliver Corp., South Bend, and W. R. Pindell, Nort Foundry & Furnace Co., Por Ore.

Issue American Standards

The 1955 edition of *Am Standards* has just been publ The 48-page publication list indexes about 1500 Am Standards, including 210 for struction and civil engineering mechanical, 272 electrical, 158 ty, 74 petroleum products, 69 ical, 62 metallurgy, 38 gas-bu appliances, and 32 drawings, symbols and abbreviations. A copy may be obtained by w American Standards Associati East 45th St., New Yark 17,

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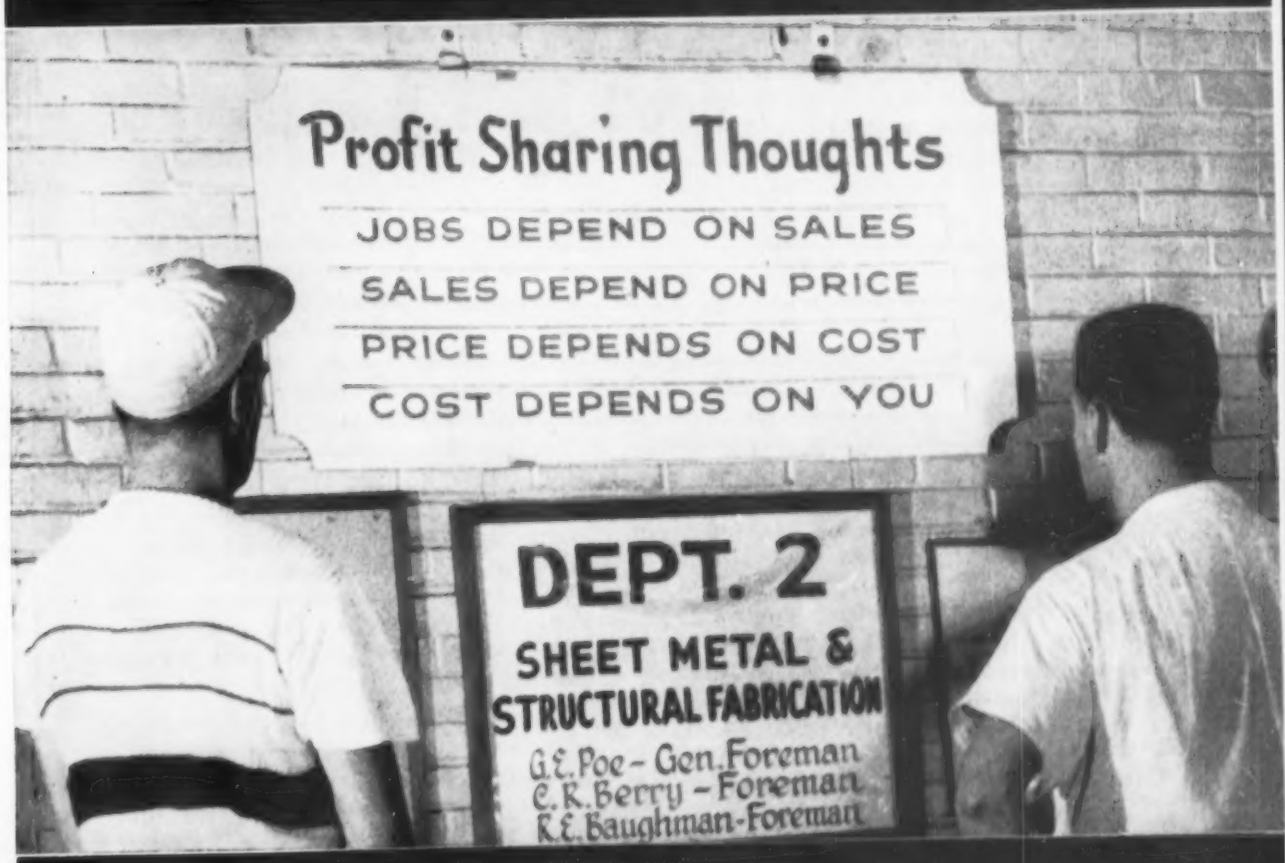
CONTROLLING COSTS in the FOUNDRY



Here's how management can tell

what costs should be . . . dollar variance from standard

. . . where variances occur

FLEXIBLE BUDGET Helps Substitute FACTS for GUESSES

■ When foundry management is informed about all the operations of the business and when facts are substituted for guesses or lack of specific and accurate information it is far more likely that management's decisions will be "good decisions" resulting in better performance.

Modern management must have "modern control" as the basis for future policies as well as for every day operations. A portion of this control is obtained through standard costs.

Modern standard cost procedure requires the establishment on a normal basis of specific quantities and purchase prices for direct material and direct labor applicable to all products and operations. A reporting procedure is established to provide management with current measurements of efficiency through comparision of actual expenditures for direct materials and direct labor with what such expenditures *should have been*. The variances between these two bases, segregated by supervisory responsibility, are reported to management for required action.

The standard cost objectives thus are:

- **The establishment** of definite specifications as to *what should be done* with respect to direct materials and direct labor costs.
- **The comparison** of actual performance to established specifications.
- **The reporting** of difference between standard and actual performance to management.

Complete cost control must not stop with direct materials and direct labor. Foundry, sales and other overhead expenses must also be controlled. Modern cost control procedure provides a sound method of controlling excessive costs of this nature through the use of the flexible budget. Control factors are established to specify allowable expenditures for such expenses as indirect labor, power, manufacturing supplies, etc., at *any level of operating capacity*. The flexible budget thus provides a means of cost analysis not possible with obsolete fixed or inflexible budgets.

Flexible budgetary control thus has as its objectives:

- The establishment of budget allowances covering overhead expenses at all levels of capacity utilization.
- The establishment of sound overhead rates.
- The reporting of variances between budget allowances and actual expenditures to management.

It is important to note that the same data required by standard costs are also essential to modern production control. These requisites include complete bills of material and routing or process instructions. The dual use of these data, of course, emphasize the close relationship of standard costs to industrial requirements.

Standard product costs (the sum of standard direct material, standard direct labor and standard foundry overhead) are, of course, ideal for use in the establishment of sales prices and basic marketing policies. These costs are computed on a normal efficiency basis (including normal overhead) thus eliminating questions which always arise as the result of fluctuating costs (in reality) due to inefficiencies and varying production volume.

The control statement which we advocate supplements the conventional form of earning report. It embodies the principles of dynamic control of progress rather than a mere calculation of profit or loss. It has as its objective the systematic revelation of sources of profit or loss; the substitution of facts for estimates, and, through management direction, the elimination of weakness.

By following this principle management will know at all times, what costs *should be*, the *dollar amount* of all variances from such specifications or standards, and *where* those variances occur.

It is our hope that this following discussion will be of some assistance in evaluating the great contribution which modern control can bring to the success of a business organization.

COST ACCOUNTING Has a New Look

ROGER K. DAILEY / *Vice Pres. Lester B. Knight & Associates, Inc. Consulting Engineers, Chicago*

■ **There has been** a rapid evolution and perfection of costing procedure in recent years, the way being led by such industries as the automobile, the appliance and other relatively new industries. With no preconceived ideas or obsolete precedents to hamper their thinking, they naturally followed the scientific approach in solving their cost accounting and cost control problems.

Cost accounting and cost control methods were formerly conceived of as merely:

- **A periodical computation** whereby expenses were divided by production in tons or other basis to determine the average cost of a ton. This cost would then be considered as bona fide until a subsequent computation of the same nature would be made.
- **A recording procedure** whereby raw materials, productive labor and overhead would be carefully accumulated and charged to individual jobs.

Dangers of Averages

Under the first method costs computed were merely averages, with all the dangers inherent in averages. So many factors were involved in the averages including production volume, varying ratio of unlike products, cost extravagance, etc., that management found the figures worthless for all practical purposes.

Under the second method, the cost by jobs could and would vary widely as between manufacturing cost of identical products due to such elements as:

- **Varying prices** paid for identical raw materials.
- **Varying material scrap,** waste and yield as between identical jobs.
- **Varying labor costs** between jobs arising from failure to equal standard, idle time, spoiled work, delays, etc.
- **Varying overhead** due to fluctuation in production volume or variations in individual items of plant expense.

Where? Yes, but Why?

In spite of such differences between the cost of separate lots of identical products, the cost accounting procedure would merely accumulate costs without reporting the reasons for the differences. On this basis management would know only that on some jobs a profit might be made while on other jobs covering the same product a lesser profit or even a loss might be computed. The basic reasons for the variance in cost and the resulting effect on profit were buried in the figures. No information was provided whereby excessive costs could be corrected by management action before they affected profits to a substantial degree.

Under either of these methods it is not too much to say that the labor and expense of compiling the figures were practically wasted. Incorrect information to management is little better than no information.

Modern Costing Procedures

Under modern costing procedure the old concept of the actual cost system is expanded to meet the following requirements:

1. All direct material, direct labor and manufacturing overhead costs are predetermined by jobs in sufficient detail to produce accurate costs in advance. Averaging of cost is avoided to the maximum extent so that full advantage may be taken of competitive costs advantages. Direct costs are based upon sound engineering and time study specifications with overhead scientifically prorated.

2. All foundry, general, administrative selling and miscellaneous costs are predetermined on the basis of master budgets. Definite dollar allowances are established by kinds of expense with flexible and fixed standards whereby actual expenses may be measured against those allowable.

3. Individual jobs after predeter-

mination of cost are verified as to their fairness. Where differentials exist, the predetermined cost will be adjusted and then considered to be standard cost for future sales quotations so long as fundamental costs do not change due to wage increases, upswing in raw material prices, etc.

4. The payroll procedure and the books of account are revised so that excessive factory labor costs, as compared to predetermined costs, are separately computed and reported currently to management. This reporting is upon the basis of daily or weekly "Labor Control Reports". This report shows by departments and by supervisory responsibility the following:

A. Actual direct labor cost.
B. Standard direct labor cost.
C. Variances from standard direct labor cost.
D. Reasons for variance by generic causes such as:
   (a) Failure to equal standard
   (b) Spoiled work
   (c) Idle time—breakdown
   (d) Idle time—material
   (e) Overtime
   (f) Other
E. Indirect labor at actual cost.
F. Indirect labor at standard cost.
G. Variance from standard.
H. Comments on indirect labor variances.
I. Total variances for the period.

5. The metal specification and input procedure and cost calculations are established so that predetermined metal costs are compared with actual and the following variances developed for management control:

A. Price
B. Input Cost—variance in ratio and thus representing a variance as compared to standard input.

6. Each month management is provided with a modern statement of profit and loss, with supporting statements showing:

Profit and Loss Statement

A. Standard gross profit which should have been realized if predetermined costs were met.
B. Excessive costs as between material, direct labor and manufacturing overhead.
C. Loss due to failure to operate at normal levels.
D. Actual gross profit after excessive costs.
E. Actual selling, general, administrative and other expense as compared to the budgeted allowances included in predetermined cost, with excessive costs revealed.
F. Operating and net profit.

Summary of Manufacturing Costs

A. Direct material excess costs due to price, excessive spoilage, non-standard yield, etc.
B. Direct labor excessive costs by causes.
C. Factory overhead costs at actual versus standard with amount of variance for month and year to date.
D. Capacity variance loss due to failure to operate at normal levels.

Direct & Indirect Departmental Costs

A separate schedule is provided for each direct and indirect department showing the same type of information as shown under the "Summary of Manufacturing Costs". This enables supervisory performance to be evaluated, and constitutes the basis of supervisory cost education.

It will thus be seen that the modern cost system not only involves cost determination but, more important, cost control. It represents the only possible technique by which management is quickly advised of excessive costs and can take immediate action to correct the situation before substantial loss is experienced.

This type of system is applicable to any company's situation. The fundamental concept is sound since it is based on the following facts:

- No sales price can be set without an estimate of cost unless the price is a pure guess.
- Having established a sales price and an estimated cost, a desired profit has been established also.
- It is axiomatic that if the costs are not controlled, the profit will not be equaled or bettered.

Two Kinds of Costs

It must be clearly understood that all costs are either controllable or of a fixed and non-controllable nature. Wherever costs can be directly related to the operation or product they are fully controllable. Where they are indirect they may be fully controllable, partially controllable or, like depreciation and insurance, practically fixed.

An overhead rate applied is a budget expressed in a percentage to direct labor dollars, hours, or other basis. Certain items in this budget are controllable, some semi-controllable, and others fixed. Hence, the modern concept of a flexible budget. This budget is flexible in that controllable costs are covered by standards which are correlated with, for example, direct labor in the molding department. Semi-variable standards are set through specific allowances at various ranges of capacity. Fixed standards remain constant under all conditions. The budget itself, when applied to actual costs, is tied into the profit and loss equation and thus mathematically reveals excessive costs.

In seeking to determine the reasons for unsatisfactory profit performance, the first control report which any management seeks to analyze is the profit and loss statement.

In most foundries, we have found that the form of profit and loss statement does not reveal the sources of loss. It does not answer such vital questions as:

- Were sales prices properly maintained?
- Were metal costs excessive as compared with estimated costs on which sales prices were or should have been based? What was the reason for the excess and what dollar amounts were involved?

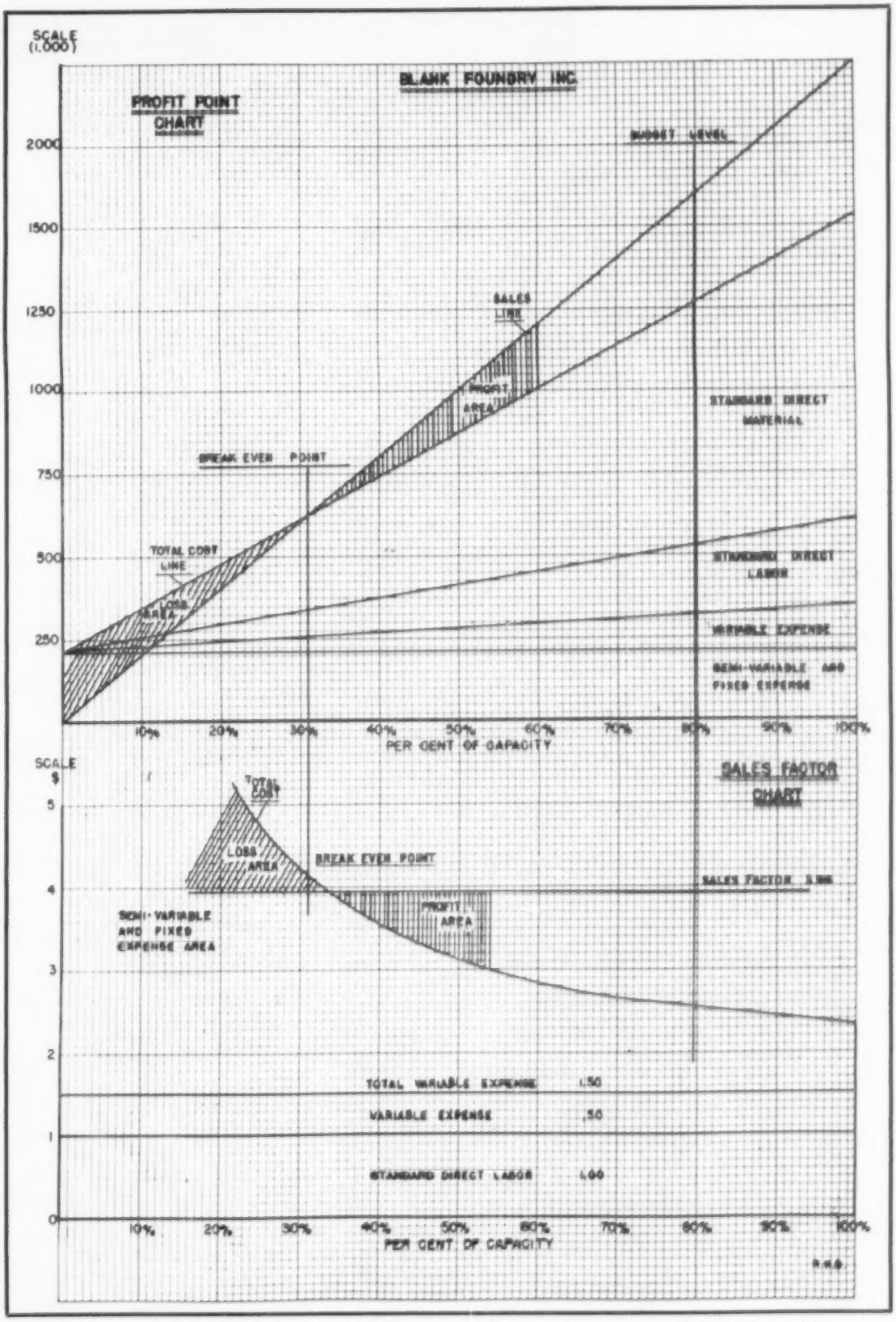


Fig. 1 . . Profit Point Chart and Sales Factor Chart of operations give scientific basis for pricing.

SPECIMEN
OPERATING PROFIT AND LOSS STATEMENT

	MONTH		YEAR-TO-DATE
Sales - Product		1,492,621.00	
STANDARD COST OF SALES			
Std. Direct Labor	194,050.00		
Std. Direct Material	722,068.00		
Std. Burden	269,500.00		
TOTAL		1,185,618.00	
STANDARD GROSS PROFIT		307,003.00	
Capacity Variance		16,800.00*	
Standard Gross Profit at Capacity Operated		290,203.00	Same
VARIANCES FROM STANDARD			Principle
Material Price	8,500.00*		
Material Usage	5,750.00*		
Direct Labor			
Failure to Equal Standard	4,350.00*		
Crew Variance	1,950.00*		
Spoiled Work	2,550.00*		
Delays	250.00*		
Overtime	-		
Mfg. Expense Variance	6,940.00*		
TOTAL		30,290.00*	
ACTUAL MANUFACTURING PROFIT		259,913.00	
SELLING EXPENSE			
Budget	33,272.40		
Variance	1,392.18		
TOTAL SELLING EXPENSE		34,664.58	
ADMINISTRATIVE DIVISION EXPENSE			
Budget	14,632.68		
Variance	976.13*		
TOTAL ADMINISTRATIVE EXPENSE		15,608.81	
OTHER INCOME AND EXPENSE			
Provision for Inventory Shrinkage	Illustrative Only.		Detail Not Shown.
P/L from Sales of Scrap			
Credit for Depr. on Fully Depreciated Assets			
Other Income and Deductions			
etc.			
TOTAL OTHER INCOME			
OPERATING PROFIT OR LOSS			

• DENOTES RED FIGURE

Fig. 2 . . A P&L statement should be prepared so as to give operational control.

- Were labor costs excessive on the basis of standard versus actual? How much and what were the reasons?
- Were overhead expenses excessive? How much and where?
- What loss was experienced due to lack of volume? What profit was due to increased business volume?
- What were the forecasted sales on which overhead rates were established? (Forecasted direct labor based on forecasted sales)

None of these data are available from the average foundry's conventional profit and loss statement. Management is thus forced to attempt explanation through statistical analysis. Usually these attempts are deficient in that:

- The averaging of metal costs in terms of net good castings reveals only a variance in averages.
- Melting costs are computed on the "per good ton" basis. What should the cost have been per your predetermined costs, and what loss or gain was experienced and why?

This same principle of average cost per ton is followed throughout their set of statements. What was the failure to equal standard; idle-time—breakdowns, idle-time—material, etc.? Could these costs have been avoided or minimized or properly controlled by the departmental supervisor as they constitute the basis for his knowing if he is or is not doing a good job with his men?

Why No Profit?

Other statements which are provided for management's guidance also fail to disclose variances which are tied into the profit and loss equations established by jobs. The result is that no scientific answer is possible to the questions raised normally by the sales department as to the reasons for lack of profit, when ordinarily such profit is included in setting the sales price upon predetermined costs.

Responsibility for incurring expenditures lies in the hands of supervision which may be prudent and economical with the company's funds or which may be extravagant or careless. Unless a foundry is operating under a standard cost and flexible budgetary control procedure it is exceedingly difficult to measure the performance of the supervisors involved from the cost standpoint.

These principles are best illustrated by reference to Fig. 2 showing a foundry's profit and loss statement as it would be prepared under standard cost and flexible budgetary control principles. It will be observed that this statement expresses income and expense items with explanations as to whether waste and extravagance existed—and if so, where. It also states whether a profit or loss was incurred due to abnormal or subnormal utilization of plant facilities—and measures this in dollars.

Away With Old-Fashioned Ideas

The specimen statement is established upon standard cost and flexible budgetary control principles that enables the significant factors mentioned above to be clearly and accurately revealed as a regular function of the accounting procedure.

The following outlines the principles which have been established to meet cost control requirements under modern conditions, eliminating the old-fashioned job cost accounting principles but revealing the control information so essential in evaluating factors affecting profit and loss:

1. The plant organization is charted and departmentalization for cost purposes is established upon the basis of:
   (a) Supervisor responsibility.
   (b) Adequate cost centers to provide correct operation costs.
   (c) Amount of cost controlled by departmental supervisors.

Such departmentalization is prerequisite to the installation of modern budgetary control of factory overhead.

2. The normal utilization of departmental capacity is determined by analysis and expressed in terms of standard direct labor dollars. At such normal point the necessary expense allowances are determined upon the basis of detailed analysis involving an examination of the need for indirect workers, the number to be allowed at normal operating levels, the decrease to be effected when operations fall below normal or the increase required by abnormal operations, etc. The allowances are segregated as between those of:
   (a) Variable nature—costs which rise and fall in a direct ratio to the production level.
   (b) Semi-variable costs — costs which rise and fall in steps as related to the production level.
   (c) Fixed costs — costs which remain constant at any level of capacity.

The allowances as established on this basis constitute a flexible budget covering overhead of the department. This budget is applied in the measurement of actual expenditures and shows where excessive costs arise and where savings are made. It represents management's opinion of what good cost performance is within the department with respect to overhead and, for the plant as a whole, what good cost performance is from the standpoint of the superintendent.

Pin Down Excess Labor Cost

3. Metal costs are computed on the basis of standard specifications and incorporated in the standard cost per ton. Standards are established covering direct labor operations, preferably upon the basis of standard data, but if essential on the basis of estimates.

4. The payroll procedures and the books of account are revised so that excessive direct labor costs are reported by cause. It thus becomes possible daily, weekly and monthly to accumulate excessive labor costs due to such causes as:
   (a) Failure to equal standard—This variance reflects the cost of not reaching the standard output required per direct labor or machine hour.

This variance is of the utmost

importance in controlling direct labor cost since it indicates the productivity which supervision is securing from the labor dollar expenditure.

(b) Rate variance—this excess cost arises where employees having an hourly rate different from the standard hourly rate are used for a particular operation.

(c) Spoiled work—The direct labor cost of spoiled work is a loss. Control is brought to bear by isolating this cost in a separate cost account.

(d) Idle time

With the foregoing established cost figures available it becomes possible to:

- Estimate jobs as budgeted cost.
- Determine through variances where estimated costs are exceeded. The variances may be traced to the particular job estimated at any time.

Summarize Manufacturing Cost

It becomes possible, with the foregoing procedure, to prepare not only the type of profit and loss statement shown in Fig. 2, but also the department summary of manufacturing expense, Figs. 6 and 7. It also becomes possible to prepare daily or weekly labor control reports, Fig. 8, showing the cost performance with respect to:

- Direct labor.
- Indirect labor with the amount and cause of any excess.

In our opinion, flexible budgetary control in combination with standard cost control is essential if profit or loss due to lack of capacity utilization be known whether it results from shortage in the sales function of the production required or productive time lost by workers who are either inefficient or unqualified.

Once the flexible budget is established many scientific management data are available with respect not only to cost control, but:

- Control of sales mixture of jobs in terms of profitability to reach a profit goal on an overall basis.
- Correct pricing is facilitated.
- The effect of volume, or lack of volume, may be measured for preplanning.
- The break-even point of the business, or a division of the business, becomes measurable.

These thoughts are illustrated in Fig. 1.

- Profit point chart—Showing profit or loss at varying capacity levels and break-even point.
- Sales price factor chart—Showing indexes at various capacity levels which represent return per dollar of standard direct labor required to meet the profit forecast.

Need Profit Point Chart

In actual application, we find few companies which maintain a current profit point chart. Yet, in our opinion, good cost costrol is one of the important contributing factors toward holding and increasing position. The clerical detail, it might be pointed out, is less than under actual job costs. If the chart of accounts is set so that variable, semi-variable, and fixed costs are automatically segregated in the books, drawing of a profit point chart is simple.

Charts Management Program

If the profit point chart is based upon a carefully prepared forecast of sales and budgeted costs for material, labor and overhead, it becomes a charted management plan. It graphically expresses the mathematical equation of business management in that (1) if the forecasted dollar sales volume is secured at the proper profit mixture and all costs are controlled to budgeted levels, (2) the forecasted profit must be realized.

SPECIMEN
SALES AND COST OF SALES ANALYSIS

	QUANTITY	SALES VALUE	MATERIAL COST	CONVERSION REVENUE	STANDARD DIRECT LABOR	STANDARD BURDEN	GROSS PROFIT	SALES FACTOR	PROFIT % TO SALES
Product A		218,361.00	107,329.00	111,042.00	28,500.00	38,200.00	43,332.00	5.80	19.8%
Product B		80,125.00	37,671.00	42,454.00	10,550.00	14,605.00	17,299.00	4.01	21.6%
Product C		82,886.00	54,004.00	28,882.00	10,780.00	14,900.00	3,202.00	2.69	3.9%
Sub-Total		381,372.00	199,004.00	182,378.00	49,830.00	68,705.00	63,833.00	3.66	16.7%
Jobber									
Product D		270,678.00							
Product E		41,145.00							
Product F		32,250.00							
Product G		494,588.00							
Product H		36,532.00		(Same Detail Shown for Each Product)					
Jobbers Sub-Total		875,193.00							
Government Work									
515		195,552.00							
585		27,446.00							
595		16,612.00							
TOTAL		1,492,621.00	722,068.00	770,553.00	196,050.00	269,500.00	307,003.00	3.96	20.6%

Fig. 3 . . This analysis explains the variations in the standard cost of sales and the resulting gross profit.

SPECIMEN
EXPENSE STATEMENT
SALES DEPARTMENT

	ACTUAL	BUDGET	VARIANCE	VARIANCE YEAR-TO DATE
Commissions	14,920.00	15,240.00	320.00	
Salaries - Other Executives	3,333.34	3,333.34	-	
Salaries - General Clerks, Stenos, etc.	2,916.67	2,916.67	-	
Bonuses and Vacations	833.34	833.34	-	
Stationery and Office Supplies	184.50	100.00	84.50*	
Postage	28.00	41.67	13.67	
Parcel Post	15.00	16.67	1.67	
Telephone and Telegraph	238.00	125.00	113.00*	
Shows, Conventions, etc.	-	566.68	566.68	Same
Entertaining Customers	165.00	100.00	65.00*	
Insurance - General	125.00	125.00	-	
Insurance - Workmen's Compensation and P. L.	16.67	16.67	-	
Old Age Benefit, Federal and State Unemployment Taxes	266.67	266.67	-	Principle
Heat, Light and Water	120.00	125.00	5.00	
Depreciation	133.34	125.00	8.34*	
Automobile Expense	475.00	408.34	66.66*	
Samples	496.30	191.67	304.63*	
Rent	434.58	439.58	5.00	
Travel Expense	2,485.00	1,375.00	1,110.00*	
Art Work	2,936.50	2,083.34	853.16*	
Direct Mail	3,042.40	3,342.75	300.35	
Group Insurance	250.00	250.00	-	
Pension Trust Insurance Expenses	1,166.67	1,166.67	-	
Other	82.60	83.34	.74	
TOTAL	34,664.58	33,272.40	1,392.18*	

* DENOTES RED FIGURE

Fig. 4 . . Sales department expense statement shows how actual costs varied from budget.

The second chart is designed primarily to reflect the vital factor of profit mixture by jobs.

We believe the foregoing comments will serve to describe the advantages of sound flexible budgetary control.

Foundry Sells Direct Labor

As is generally recognized, a foundry, more than any other industrial operation, primarily sells its productive time and direct labor.

If the operations of the company are charted in the form of a profit point chart as we have done in Fig. 8, it is clear that mathematically pricing should not be accomplished by mark-up or by adding on a percentage of total cost but should be scientifically established on the basis of the following formula:

1. Determine the sales volume at which the plant is budgeted to operate in terms of net sales dollars.

2. From net sales at the budgeted point, deduct the standard cost of material. The company did nothing to create the material and should not receive a profit thereon. The company, rather, must obtain its profit from compensation for its productive time and the skill and effort which it applies to the raw material. The balance, after deducting material costs from net sales, represents "conversion revenue" the compensation for the company's skill, time and effort.

3. Dividing the conversion revenue at the budgeted sales point by budgeted standard direct labor re-

SPECIMEN
EXPENSE STATEMENT
ADMINISTRATIVE DIVISION

	ACTUAL	BUDGET	VARIANCE	VARIANCE YEAR-TO-DATE
Salaries - Officers	6,250.00	6,250.00	-	
Salaries - Other Executives	2,083.70	2,083.70	-	
Salaries - Accounting	2,083.70	2,083.70	-	
Salaries - General Clerical	1,666.67	1,666.67	-	
Bonus and Vacation	166.67	166.67	-	
Stationery and Office Supplies	398.00	250.00	148.00*	
Postage	36.20	16.66	19.53*	
Parcel Post	5.10	8.34	3.24	
Telephone and Telegraph	73.80	66.67	7.13*	
Entertaining Customers	-	-	-	
Insurance - General				
Insurance - Workmen's Compensation and P. L.	25.25	25.25	-	
O. A. B. - Federal and State Unemployment Taxes	200.00	200.00	-	Same
Heat, Light and Water	-	-	-	
Depreciation	58.34	58.34	-	
Automobile Expense	-	-	-	Principle
Samples	-	-	-	
Rent	608.81	615.81	7.00	
Travel Expenses	294.85	166.67	128.18*	
Dues, Memberships & Subscriptions	66.00	16.67	49.33*	
Donations	110.00	16.67	93.33*	
Collection & Credit Expense	68.75	65.84	2.91*	
Legal & Professional Services	934.30	416.67	517.63*	
Group Insurance	166.67	166.67	-	
Pension Trust Insurance Expense (Salary Employees)	250.00	250.00	-	
Other	62.00	62.00	-	
TOTAL	15,608.81	14,632.68	976.13*	

* DENOTES RED FIGURE

Fig. 5 . . Variance from budget shows up in administrative expense.

veals the return in dollars per dollar of productive labor. Every dollar of productive labor in the company is entitled to the same return unless management is willing to accept the premise that a dollar of direct labor of one employee is less valuable than the dollar productive labor of another employee. This point of view, of course, is uneconomical. A dollar of productive labor or a dollar of productive time represents the only real commodity which the company is selling.

In the case of the illustrative charts shown (Fig. 1) the conversion revenue per dollar of direct labor totals 3.96. This means that every job run by the company should result in a payment by the customer of not less than 3.96 per dollar of direct labor.

Reversing the process above described and applying the principle to individual estimates, it is clear that:

1. If all sales prices are set by multiplying the estimated standard direct labor by 3.96 and adding the cost of the material, the charted profit can be realized.

2. If sales volume as charted is realized, the volume factor in cost is realized.

3. If direct labor, division overhead, general overhead, selling expense and administrative expense elements are controlled to the standard and budgeted level, the profit charted mathematically must be realized.

In actual practice the index or pricing factor as above described may be used as an indicator or guide.

Proper pricing for maximum profit is a problem of every foundry. Selling prices should be correctly established before the sales department or others alter them to meet conditions that affect salability. Under-pricing may result in excessive sales on the under-priced product, reducing the available total profit upon the foundry's volume. Over-pricing may so restrict sales that profits that should have been secured are lost.

Standard costs determine what individual products *should* cost so that it becomes possible to ascertain what the total costs of operating should be at all capacity levels. The foundry offers for sale its facilities, services and abilities in converting raw materials into a finished product so that the real "sale" becomes that value received for the service or conversion effort which is represented by the amount remaining after deducting direct material costs from the selling price.

When profits are based upon selling prices calculated upon both material and manufacturing cost, the varying proportion of materials in several different products will distort the profit return upon these products. This may be illustrated by the selling price obtained on three different products:

	Pattern NP 11	Pattern 524	Pattern NP-2B
Material cost	101.81	250.00	565.00
Direct labor	88.33	102.00	126.25
Burden (150%)	132.50	153.00	189.38
Total cost	322.64	505.00	880.63
Gross profit at 25% of cost	80.66	126.25	220.16
Selling price	$403.30	$631.25	$1,100.79

Assuming it had been decided that the foundry was entitled to a profit which resulted in a sales factor of 4.00, then the correct selling prices would be as follows:

Pattern NP 11	
Material Cost	$101.18
Conversion Price	353.32
Selling Price	455.13
Pattern 524	
Material Cost	250.00
Conversion Price	408.00
Selling Price	658.00
Pattern NP-2B	
Material Cost	565.00
Conversion Price	505.00
Selling Price	1,070.00

Pattern NP 11 and Pattern 521 should be advanced in price and Pattern NP-2B should be reduced in price and regardless of the class of product sold, the final profit to the foundry would be the same.

Knowing the total operating expenses of the business at any capacity level, knowing the value of the standard direct labor at such levels, and also knowing the total profit desired at each capacity level, it becomes a simple matter to determine the necessary cost plus profit, (exclusive of material cost), and to determine what ratio this amount is to the standard direct labor cost—thus determining the "sales factor" necessary to produce such results.

Fig. 6 . . Manufacturing expense summarizes the variances from standard of profit and loss statement (Fig. 2).

SPECIMEN
SUMMARY OF MANUFACTURING EXPENSE

	ACTUAL	BUDGET	VARIANCE	VARIANCE YEAR-TO-DATE
Direct Labor	194,050.00			
MANUFACTURING EXPENSE				
VARIABLE				
Material Variances				
Material Price	8,500.00		8,500.00*	3,600.00*
Material Usage	5,750.00		5,750.00*	29,420.00*
Direct Labor Variances				
Failure to Equal Standard	4,350.00		4,350.00*	14,600.00*
Crew Variance	1,950.00		1,950.00*	9,450.00*
Spoiled Work	2,550.00		2,550.00*	6,020.00*
Delays	250.00		250.00*	1,850.00*
Overtime	-	-		
Other	-	-		
Workmen's Compensation & Public Liability	4,310.00	4,300.00	10.00*	340.00*
Power	12,565.00	10,500.00	2,065.00*	3,555.00*
Supplies	1,560.00	1,420.00	140.00*	500.00
O.A.B. Federal & State Unemployment Taxes				
Fuel and Water	2,360.00	2,460.00	100.00	25.00*
Miscellaneous	95.00	105.00	10.00	15.00
SEMI-VARIABLE AND FIXED EXPENSE				
Supervision - Salaries	8,500.00	8,500.00	-	-
Supervision - Wages	9,600.00	9,600.00	-	-
Experimental - Indirect Labor	1,505.00	1,200.00	305.00*	50.00
Clean-Up - Indirect Labor				
Shipping, Receiving and Stores, Clerical				
Watchmen and Guards				
Janitors and Sweepers				
Material Handlers				
Inspectors	(The remainder of this Statement is compared			
Training Employees	in detail to the Budget in the same manner as above)			
Service Truck Drivers				
Boiler Firemen				
General Clerical				
O.A.B. - Feder & State Unemployment Taxes				
Indirect Labor Overtime Premium				
Maintenance and Repair - Labor - Mach. & Equip.				
Maintenance and Repair - Labor - Bldgs. & Grounds				
Maintenance and Repair - Mat'l., Mach. & Equip.				
Maintenance and Repair - Mat'l., Bldgs. & Ground				
Janitor Supplies				
Shipping Supplies				
Freight, Express and Cartage - In				
Telephone and Telegraph		(Detail Omitted)		
Taxes, Real Estate and Personal Property				
Insurance - General				
Group Insurance				
Depreciation - Machinery and Equipment				
Depreciation - Buildings				
Due and Subscriptions (Factory Only)				
Travel Expense				
Fuel and Water				
Power				
Light				
TOTAL	230,882.00	200,592.00	30,290.00*	
	183,792.00	183,792.00		
	47,090.00			
Capacity Variance		16,800.00*		
Manufacturing Expense Variance		30,290.00*		
		47,090.00*		
Manufacturing Expense Variance				
Material Price		8,500.00*		
Material Usage		5,750.00*		
Direct Labor				
Failure to Equal Standard	4,350.00*			
Crew Variance	1,950.00*			
Spoiled Work	2,550.00*			
Delays	250.00*			
Overtime	-			
Other	-			
TOTAL		9,100.00*		
Manufacturing Expense		6,940.00*		
TOTAL		30,290.00*		

* DENOTES RED FIGURE

CONTROL REPORTS
Are the Tools of Management

■ The following typical reports, based on standard cost and flexible budgetary control principles, were designed to provide management with every possible "signal" indicating efficient or inefficient performance in the manufacturing operation. The degree of control realized is obviously dependent upon the steps taken by management to analyze and correct weaknesses shown. The system, however, automatically places before management all facts necessary to institute aggressive executive action.

The following specimen statements were designed to bring out operating control principles for the purpose of this story and are not meant to represent the actual financial statements in their finished form. Nor are we including such supplementary statements that management may want included.

Following are the suggested statements for a foundry, comments upon which will appear later:

SPECIMEN
SUMMARY OF MANUFACTURING EXPENSE
DEPARTMENT "A"

	ACTUAL	BUDGET	VARIANCE	VARIANCE YEAR-TO-DATE
Direct Labor at Standard	34,100.00			
MANUFACTURING EXPENSE				
VARIABLE				
Material Variances				
Material Price	-			
Material Usage	875.00		875.00*	
Direct Labor Variances				
Failure to Equal Standard	620.00		620.00*	
Crew Variance	2,140.00		2,140.00*	
Spoiled Work	105.00		105.00*	
Delays	780.00		780.00*	
Overtime	65.00		65.00*	
Other	-			
Workmen's Compensation & Public Liability	682.00	682.00	-	
Power	5,110.00	3,121.70	1,988.30*	
Supplies	340.00	598.20	258.20	
O.A.B. - Federal & State Unemployment Taxes	1,505.80	1,360.00	145.80*	Detail
Fuel and Water	1,250.00	1,200.00	50.00*	
Miscellaneous	35.00	40.00	5.00	Not
SEMI-VARIABLE AND FIXED				
Supervision - Salaries	6,791.00	6,794.00	3.00	
Supervision - Wages	4,675.00	4,672.70	2.30*	Shown
Experimental - Indirect Labor	-	582.00	582.00	
Clean-Up - Indirect Labor	-	700.00	700.00	
Shipping, Receiving and Stores, Clerical	1,226.32	1,333.35	107.03	
Watchmen and Guards	1,021.73	1,021.73	-	
Janitors and Sweepers	880.00	880.00	-	
Material Handlers	2,666.00	2,741.70	75.70	
Inspectors	1,084.00	1,149.00	65.00	
Training Employees	600.00	417.00	183.00*	
Service Truck Drivers	585.00	585.00	-	
Boiler Firement	227.04	227.04	-	
General Clerical	6,066.00	6,063.00	3.00*	
O.A.B. - Federal & State Unemployment Taxes	1,162.88	1,176.70	13.82	
Indirect Labor Overtime Premium	2,060.00	2,061.90	1.90	
Maintenance & Repair - Labor, Mach. & Equip.	985.00	815.20	169.80*	
Maintenance & Repair - Labor, Bldgs. & Grounds	792.00	892.00	100.00	
Maintenance & Repair - Mat'l., Mach. & Equip.	685.00	710.73	25.73	
Maintenance & Repair - Mat'l., Bldgs. & Grounds	352.00	369.00	17.00	
Janitor Supplies	132.00	82.00	50.00*	
Shipping Supplies	725.26	668.00	57.26*	
Freight, Express and Cartage In	600.00	584.00	16.00*	
Telephone and Telegraph	100.00	224.90	124.90*	
Taxes - Real Estate and Personal Property	1,466.08	1,466.08	-	
Insurance - General	733.04	733.04	-	Detail
Group Insurance	1,280.00	1,250.00	30.00*	
Depreciation Machinery and Equipment	11,241.50	11,241.50	-	Not
Depreciation Buildings	1,466.96	1,466.96	-	
Dues and Subscriptions (Factory Only)	-	37.44	37.44	Shown
Travel Expense	200.00	83.30	116.70*	
Fuel and Water	700.00	667.00	33.00*	
Power	975.00	833.00	142.00*	
Rent	800.00	800.00	-	
TOTAL	65,786.61	60,331.17	5,455.44*	

* DENOTES RED FIGURE

Fig. 7 . . Management, after referring to the summary report, will trace variances to the direct departments.

	Figure
Operating Profit & Loss Statement	2
Sales & Cost of Sales Analysis	3
Expense Statement - Sales Department	4
Expense Statement - Administrative Division	5
Summary of Manufacturing Expense	6
Summary of Departmental Manufacturing Expense - Department "A"	7
Labor Control Report	8

Balance Sheet

In this report we have not included a balance sheet. However, the generally accepted form of balance sheet is used. The system, however, requires the evaluation of work-in-process and finished goods inventory at standard cost rather than the so-called actual cost.

We might suggest that the current ratio and also the net working capital be tabulated for ready reference by management. Also separate reports for the surplus statement, etc., may be prepared if desired.

Comparative Profit and Loss Statement

Fig. 2 shows a specimen profit and loss statement for the company. This specimen statement is intentionally condensed to the maximum possible degree for quick evaluation of results in total. It summarizes the results for the month; it shows gross dollar sales; the total returns, allowances and discounts which must be deducted from gross sales, and the resulting balance of net sales.

From the net sales is deducted the standard cost of sales of all products sold. Observe that here the principles of standard cost accounting are introduced in that it is unnecessary to use inventories to arrive at the correct cost of sales. It is only necessary to:

1. Establish standard costs per unit covering:
   A. Direct materials
   B. Direct labor
   C. Overhead

   The total represents the total standard cost of the particular products involved.

2. Multiply the products sold by the proper standard cost, the mathematical total constituting standard cost of sales.

After deducting standard cost of sales from net sales, the resulting balance represents the standard gross profit. On the specimen statement this amounts to $307,003.00 and is the gross profit which the company should earn.

The company did not, however, earn its standard gross profit for the month. Observe that from the standard gross profit are deducted:

- Capacity variances
- Direct material variances
- Direct labor variances
- Manufacturing expense variances

Here in four tabulations are summarized the plant's excessive costs for the month. The capacity variance shows the extra cost incurred due to not operating the foundry at its normal capacity. The direct material variances reflect the excess cost of direct materials used; the direct labor variances reflect excessive expenditures for direct labor and the manufacturing expense variances show the unnecessary expenditures incurred for this class of expense.

Deducting (or adding thereto if savings) variances from standard gross profit reveals actual gross profit. From such profit are deducted selling, general and administrative costs at budget and excessive cost totals. The balance constitutes net operating profit; the balance between other income and expense is added or deducted. The remainder constitutes net profit for the month before provision for taxes.

Observe that this statement is prepared monthly with a comparison against prior month's results. Management may thus month by month compare sales trends, measure variances in total against the prior month, etc.

Having analyzed this statement, and observing results in condensed form, management will desire detailed information for the purpose of clearly understanding the elements involved and their effect on profit results. In the case of sales, for example, management will desire to know the gross profit contribution by new products, etc. Ordinarily the ratio of gross profit varies as between products, hence to understand the total gross profit the relative importance of such products must be evaluated.

Sales and Cost of Sales Analysis

The source of the foregoing information is Fig. 3, "sales and cost of sales analysis," shown on page 46.

This analysis explains the variations in the standard cost of sales and the resulting gross profit. It analyzes the sales into major product classifications and reveals the standard cost and the standard gross profit for each product class.

The gross profit usually varies among product classifications. Consequently, as sales of the higher gross profit items increase the total standard gross profit increases and vice versa.

Very often management in scrutinizing the conventional profit and loss statement will note a variance in gross profit ratio and will then call for an explanation. Such an explanation is impossible under the conventional method of treatment since the gross profit includes a composite of many variances. The only variances possible in a modern cost procedure, however, are variations in ratios among the product classes, or the failure to maintain established selling prices.

Selling prices may be measured by a selling price index or sales factor. By the use of the sales factor the amount which the actual selling price may be above or below the established price is determined. Another application of the sales factor is the scientific determination of the profitablility of individual products from the point of view of utilization of plant facilities and production effort. (Note: the necessary inclusion of material costs in determining gross profit many times confuses true profitability of a product.)

Summary of Manufacturing Expense

The summary of manufacturing expense shown in Fig. 6 summarizes the variances from standard as shown on the condensed profit and loss statement. This provides for management the essential facts with respect to costs incurred by the plant direct and indirect departments as follows:

- Actual monthly expenditures.
- Budgeted expenditures for the month.
- Variances from standard or from budgeted allowances for the month.
- Variances from standard or from budgeted allowances for the year-to-date.

The management control features of this report are described in the following:

■ **Direct materials at standard $140,000.00.** This is the total of direct materials used in accordance with standard specifications, and priced at standard. It will be noted that the identical amount is shown under the heading, "budget". The material cost variances will be observed by reference to the first two items under "manufacturing expense—variable" discussed subsequently.

■ **Direct labor at standard $194,050.00.** This is the total expenditure for direct labor as allowed by the standard labor specifications. Variances are listed subsequently.

The following comments relate to the balance of the cost comparisons included under the caption, "manufacturing expenses". It will be observed that these expenses are segregated as between "variable" and "semi-variable and fixed". As has been discussed previously, the variable expenses are those which rise and fall with production volume; the semi-variable expenses rise and fall in a certain relation to production volume, but not in precise synchronization therewith. The fixed expenses, of course, are incurred regardless of the production volume as in the case of depreciation, which is the same whether the plant operates at 100% or 20% of normal capacity.

It will be observed that both direct material and indirect labor variances from standard are included under variable manufacturing expenses.

■ **Material variance—price $8,500.00.** This item reports to management the fact that the purchasing department paid $8,500.00 in excess of standard for direct materials purchased during the month. Complete explanation of such variances when a substantial amount is involved should be required from the purchasing agent, since poor buying may be indicated or a change in sales prices may be desirable.

It should be understood that the material price variance may be handled according to the policy decided upon by management. If the material price variance is taken directly to profit and loss (as has been done in the illustrative statements herein) it will reflect a profit or a loss on the purchases for the current period. Another method of handling this price variance is to take the price variance to the balance sheet and dispose of it to the profit and loss statement as material enters the cost of sales.

■ **Material variance—usage $5,750.00.** This item reports that the production departments used a considerable quantity of direct materials in excess of standard. Departments incurring such excesses are listed in the detail "cost to manufacture" reports subsequently described. Complete explanation of the kinds and quantities of excess materials may be readily obtained from the accounting department. As a matter of fact, the plant auditor in cases of unusual variances should accompany his report with an analysis of such excesses.

■ **Direct labor variances—failure to equal standard $4,350.00.** As will be subsequently described under "direct labor standards", normal output required per direct labor or machine hour is established as standard. This variance reflects the cost of failure to reach the required standard output. The departments contributing to this excess are shown in the "cost to manufacture" reports prepared for each direct or productive department.

This variance is of the utmost importance in controlling direct labor costs, since it indicates the productivity which supervision is attaining from the direct labor dollar expenditure.

■ **Spoilage—$2,550.00.** This variance reports the excess cost due to spoilage of material, etc. Whenever a direct labor employee performs labor upon material, etc., and such material is unsatisfactory and must be scrapped, the original labor cost of such processing is lost. This variance reports the amount so lost for the month.

■ **Delays—$250.00.** This item reports the excess cost of direct labor due to waiting for material, waiting for orders, waiting for machine repairs, etc. The extent of such idle time provides management with a valuable criterion as to the extent of efficiency in planning, scheduling, maintenance of machines, etc.

The foregoing covers an outline of the control information covering materials and direct labor presented to management. It should be noted that these variances cover the entire plant, not individual departments, and are designed to reflect in total for the month the controllable losses experienced through weaknesses in operation. These variances are variances from standards, not from budgetary allowances provided by the flexible budget. No budget provisions are included to offset these variances for obvious reasons.

In the balance of the report the manufacturing expenses or burden items are analyzed. In the first column the actual expenditure for the month is indicated; in the next column the flexible budgetary allowance for the month; in the third column the variance from the budgetary allowance for the month and in the fourth column the budgetary variance for the year-to-date.

The remaining expense comparisons on this report might be analyzed in the same manner as the foregoing. The usefulness of the report should, however, be apparent from the foregoing discussion.

At the end of the report, it will be observed that the total manufacturing cost is segregated in a summary as between—

- Capacity variance
- Direct material variance
- Direct labor variance
- Manufacturing expense variance

The total of the standard material, labor and burden cost for the month is charged directly to the work in process inventory, since they represent the standard cost of manufacture for the month. The capacity variance reflects the difference between the standard burden (used in the standard cost compu-

tations of individual products) and the standard burden allowable to the plant at the actual production level attained during the period.

In establishing the standard burden rate it is necessary that a predetermined capacity level be used as well as a predetermined expense level. Should the sales department provide the plant with a volume less than the predetermined or anticipated average monthly volume there will be certain semi-variable and fixed expenses which cannot be reduced to the new capacity level and which must, therefore, be absorbed by the smaller production and thus act to increase the unit cost of production for the current period. Inasmuch as the plant cannot be responsible for either a lack of sufficient production volume or a greater production volume than estimated in the burden rates, the cost due solely to actual volume varying from the predetermined volume is termed the capacity variance and for its correction the company must look to the sales department. See note below.

The capacity variance, therefore, tells management the cost effect, measured from the standard cost level, of either a lack of volume or an additional volume over the normal standard capacity level.

In the ordinary types of costing an amount termed "over or under absorbed burden" is shown as a part of the cost of sales and represents the difference between manufacturing expense at a predetermined level and the actual costs incurred. The difference between the manufacturing costs allowed at a predetermined level and the total costs incurred express in one amount all manufacturing expense variances and capacity variance thus destroying any possibility of analyzing causes for variances in manufacturing expense and, thereby, failing to provide any scientific basis for control of manufacturing expense.

There are two elements in the total under or over absorbed burden:

- The production volume required to meet the predetermined capacity level anticipated when the burden rates were established. (This we denote as a capacity variance, and have heretofore described it).
- The ability of the manufacturing departments to meet the expense allowances used in determining the manufacturing burden rates.

In the illustrative statement capacity and budgetary expense variances have been segregated, the capacity variance being computed as $16,800.00 representing loss due to lack of utilization of normal budgeted capacity, and cost excesses of $30,290.00 including:

Direct material excesses	$14,250
Direct labor excesses	9,100
Manufacturing expense excesses	6,940
	$30,293

These amounts have been charged directly to profit and loss as previously commented on and represent the cost of operating weaknesses for the month.

NOTE: Where direct labor fails to perform at standard,this will also affect the capacity variance.

Direct Departmental Cost to Manufacture

These reports summarize the results of operations for each direct department. There is included in Fig. 7 an illustrative report covering the Department "A".

This report is almost identical with the summary of cost to manufacture as described under the previous caption. The summary report, in fact, is merely a summarization of the results shown by the various departmental reports.

Management, after referring to the summary report, will trace the variances to the direct departments concerned. Since each direct department is reported, management is thus enabled to gauge the efficiency of individual departmental supervision. All items shown under variable expense are directly con-

SPECIMEN
LABOR CONTROL REPORT

DIRECT LABOR — INDIRECT LABOR

RATING %	ACTUAL DIRECT LABOR	STD DIRECT LABOR	TOTAL VARIANCE	REASON FOR EXCESS: FAILURE TO EQUAL STD	REASON FOR EXCESS: CREW VARIANCE	REASON FOR EXCESS: DELAY	REASON FOR EXCESS: ETC	DEPARTMENT	ACTUAL INDIRECT LABOR	STD	TOTAL EXCESS	RATING %	INDIRECT LABOR DISTRIBUTION	TOTAL EXCESS DIRECT & INDIRECT	TOTAL RATING %	TOTAL PAY ROLL
								DIRECT								
								A								
								B								
								C								
								D								
								E								
								F								
								G								
								INDIRECT								
								M								
								N								
								O								
								P								
								etc								

Fig. 8 . . Typical daily (or weekly) direct and indirect labor control report with which management is provided.

Elect Local NFFS Officers

New officers for local chapters of the Non-Ferrous Founders' Society, Inc., have been elected as follows:

Cleveland—chairman, Walter O. Larson, Jr., Grafton Foundry Co., Grafton, Ohio; vice-chairman ,A. E. Schauer, Schauer Brass & Aluminum Foundry, Cleveland; treasurer, D. B. Kennedy, Gluntz Brass & Aluminum Foundry, Cleveland; secretary, W. O'Malley, Wellman Bronze & Aluminum Co., Cleveland.

Philadelphia—chairman, Robert Stokes, Philadelphia Bronze & Brass, Philadelphia; vice-chairman, Robert Patten, Patten Machine & Foundry Co., Trenton, N. J.; secretary-treasurer, Robert Thompson, Crown Non-Ferrous Foundry, Chester, Pa.

Wisconsin—chairman, Edward E. Jagmin, Ampco Metals, Inc., Milwaukee; vice-chairman, John Taylor, Loeffelholz Co., Milwaukee; secretary-treasurer, J. A. Westover, Westover Engineers, Milwaukee.

Bujold to Address Equipment Manufacturers Annual Meeting

Again this year the Greenbrier Hotel in White Sulphur Springs, W. Va., will be the site of the annual meeting of the Foundry Equipment Manufacturers Association. October 13-15 are the dates.

Principal speaker will be Frank X. Bujold, manager of foundries, Ford Motor Co., who will discuss *"Foundry Products in Relation to the Automotive Industry."*

Meetings on the first day will cover such topics of interest to the various product groups as blast cleaning and tumbling, dust and fume control, flasks and accessories, material handling and processing, and molding and core machines.

In the general business sessions, open discussions will be held on problems affecting the industry, business trends, and the rate of activity in the foundry equipment industry. The FEMA Statistical Program will be analyzed and interpreted, and the operations of the Washington Office will be reviewed. Three directors, a president, a vice-president, an executive secretary, and a treasurer will be elected.

A partial list of Knight clients

Acindar
Buenos Aires, Arg.
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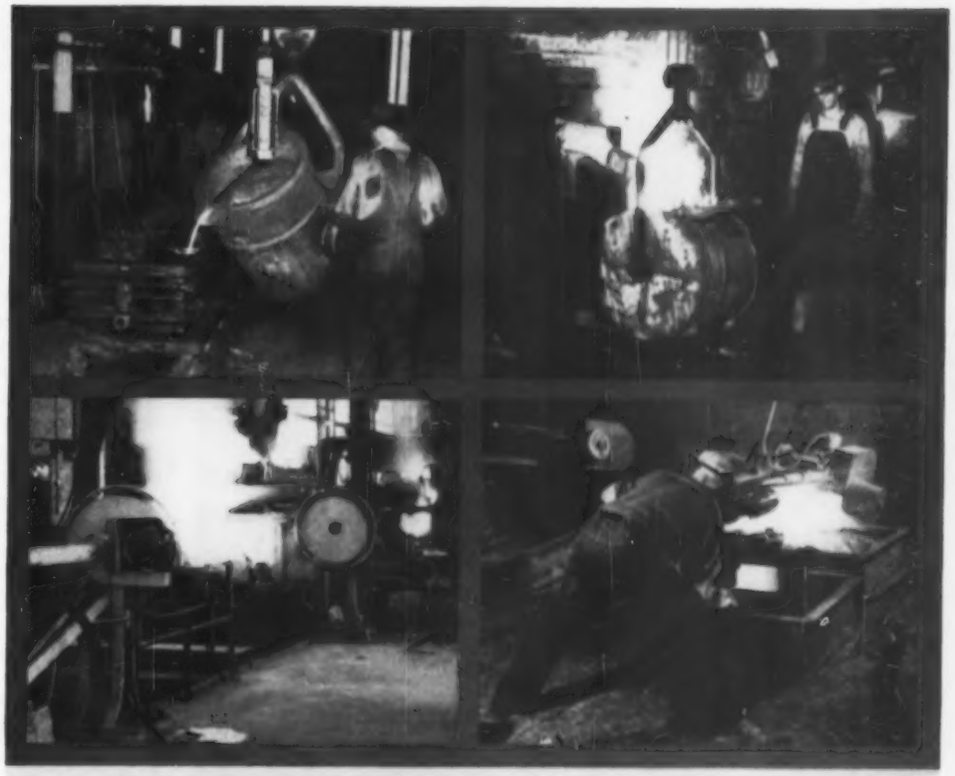
Villa Constitucion, Arg.
American Radiator & Standard Sanitary Corp.
Baltimore and Louisville
Appleton Electric Company
South Milwaukee, Wis.
B.I.F. Industries, Inc.
Providence, R.I.
Canadian Car and Foundry Company, Ltd.
Montreal, Quebec
Chrysler Corp.
New Orleans, La.
Combustion Engineering Inc.
Chattanooga, Tenn.
Crane Company
Chicago, Ill.
Dalton Foundries, Inc.
Warsaw, Indiana
Electric Steel Foundry Company
Portland, Ore.
Erie Malleable Iron Company
Erie, Pa.
Fahralloy Limited
Orillia, Ont.
Fairbanks, Morse & Company
Kansas City, Kan.
Ft. Pitt Steel Castings Division
McKeesport, Pa.
Hammond Brass Works
Hammond, Ind.
Haynes Stellite Company
Kokomo, Ind.
Macfarlane
Sagua la Grande, Cuba
Moline Malleable Iron Company
St. Charles, Ill.
National Roll & Steel Foundry
Avonmore, Pa.
Pittsburg Steel Foundry Corporation
Glassport, Pa.
Pyle-National Company
Chicago, Ill.
Sulzer Bros. Ltd.
Winterthur, Switzerland
Unitcast Corporation, Ltd.
Sherbrooke, Quebec
Universal Castings Corporation
Chicago, Ill.
Wagner Malleable Iron Company
Decatur, Ill.
Woodruff & Edwards, Inc.
Elgin, Ill.
Worthington Corporation
Harrison, N.J.



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CIRCLE NO. 85, PAGE 81-82

trollable by the departmental supervisor except the cost included under the caption "proration from indirect departments". The costs included under semi-variable expense are controllable in part, the extent of control being established in preparing the flexible budgetary allowances therefor. The fixed items are, of course, not controllable directly by the departmental supervisor.

Daily Labor Control Report

Management is provided with a daily (or weekly) labor control report, similar in principle to the one shown in Fig. 8. This report shows by departments the following:

Direct or producing departments
- Direct Labor
  - Performance rating
  - Actual direct labor
  - Standard direct labor
  - Variances in total—direct labor
  - Explanation of variances
    - (a) Failure to equal standard
    - (b) Spoiled work
    - (c) Idle time—breakdown
    - (d) Idle time—material
    - (e) Overtime
    - (f) Other
- Indirect labor
  - Actual indirect labor
  - Standard indirect labor
  - Variance
  - Explanation

Indirect or Non-Producing Departments
- Indirect labor
  - Actual indirect labor
  - Standard indirect labor
  - Variance
  - Explanation

Following is an explanation of the use of the form and the control data to be obtained therefrom by management:

1. The report may be prepared daily or weekly to cover the payroll for the preceding day or week.
2. The department name is shown in the first column.
3. The percentage of actual cost or direct labor as compared with the standard is shown in the column headed "rating". In the illustrative report, for example, if the heavy machining department's actual direct labor had been $671.20 and the standard was $635.00, their rating would be 94.6% of standard. This is computed as follows:

$$\frac{635.00}{671.20} \times 100 = 94.6\% \text{ or}$$

by formula

$$\frac{S}{A} \times 100 = R \text{ where}$$

A = Actual Direct Labor
S = Standard Direct Labor
R = % of Rating

The ratings for all direct departments are combined at the bottom of the form.

4. The actual expenditure for direct labor for the day or week is shown in the column headed "actual".
5. The standard direct labor cost for the day or week is shown in the column headed "standard". (Computed by multiplying completed production by the established standard direct labor cost per unit, or per the standard piecework or other incentive pay basis).
6. The difference between "actual" and "standard" direct labor cost is shown in the column headed "variance".
7. A breakdown of the total "variance" as computed under (6) is shown in the section headed "explanation of variances". This segregation is based on data recorded on the time cards in the direct departments.

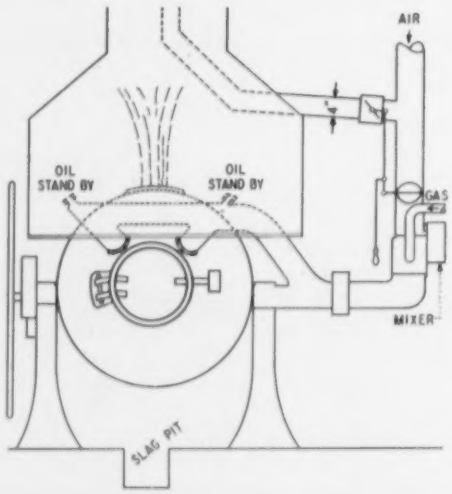
Now There's an Idea

Auxiliary Air Controls Furnace Fumes

■ The gravity-type hood installed over this oil-fired kettle furnace removed fume effectively during the melting cycle because the heat from the furnace produced sufficient thermal draft.

However, when the furnace was shut down for pour off, fumes escaped from the hood because of the vacuum caused by roof ventilators in the plant.

To correct this condition, Bill Chivvis and his men of the Magnus Metal Div., National Lead Co., in Denver, worked out this simple solution.



When air to the burner is shut off, it is automatically by-passed to a 4-in. pipe which discharges into the throat of the exhaust hood. The venturi effect produced creates sufficient draft to prevent escape of fume during pour off and skimming.

The device was built by the maintenance department with scrap material found in the shop.

Monolithic lining for a desulphurizing forehearth is being rammed-up of a clay-graphite plastic between a pattern and the ladle refractory shell.

FOR SODA ASH DESULPHURIZING . . .

What You Should Know About Forehearth Refractories

They don't all behave alike and some will surprise you

RALPH CARLSON / *Asst. Melting Supt. American Cast Iron Pipe Co. Birmingham, Ala.*

SAM F. CARTER / *Melting Supt. American Cast Iron Pipe Co.*

■ A seven-year search for the most suitable refractory for forehearth soda ash desulphurizing of gray iron indicates that clay plastic containing graphite lasts nearly twice as long as straight clay plastic, against heavy soda ash slag in one of our forehearths. And it is cheaper, over-all, than a brick lining. On the other hand, dense clay brick in another forehearth, with certain process variations, excel monolithic linings.

The search did not reveal any material completely resistant to soda or any best material for all conditions. However, our experiences will help some operators faced with this problem and may also help refractory producers in the search for better materials for soda ash service.

Obviously, size and shape of the vessel, length and continuity of heats, ease of changing, opportunity to patch, type of labor available, and many other factors vary in different plants and make one material fit one operation and not another.

Desulphurizing gray iron with salts of sodium in forehearth or receiving ladles has been one of the most popular means of reducing excessive sulphur contents. Although, in recent years other methods have been developed and the basic cupola permits sulphur control in melting, there are a number of circumstances where acid cupola melting and slight reduction of sulphur with sodium carbonate is still considered the most practical method of sulphur control.

Large and Small Forehearths

The principal problem of soda ash treatment has always been the maintenance of refractory lining against basic slag attack. Refractory linings that normally last indefinitely in cast iron service are consumed rapidly when exposed to this treatment.

In the authors' plant, soda ash desulphurization is employed on two of five cupolas—regularly on a small cupola melting 1½ tons per hour and most of the time on a 40-ton/hr furnace (when scrap price and availability make it practical). Forehearth details are shown in Table 1.

Most refractory tests were made on the small forehearth ladle where two ladles were alternated each day, making it easier to study the progress of attack. And because the small ladle presents a greater area of contact relative to volume and the large amount of soda ash (12 lb/ton) makes refractory attack unusually severe, we considered this a good place to test refractories.

Tests on the large forehearth where the soda ash addition is much less (2-5 lb/ton), iron temperature is lower, and chemical attack is not so severe, revealed other factors to be more important.

TABLE 1 . . FOREHEARTH DETAILS

Forehearth	Small	Large
holding capacity	500 lb	12,000 lb
melting rate	1½ T/hr	32-40 T/hr
length of day	8-12 hr	16-20 hr
lining thickness	5 in.	10 in.
inside dimen.	15 in. diam.	28 × 52 in.
height	21 in.	47 in.
soda ash addition	12 lb/T	2-5 lb/T
iron temperature (cupola stream)	2750-2800F	2600-2650F
	Avg %	Avg %
initial sulphur	0.14-0.18	0.11-0.14
final sulphur	0.07-0.09	0.08-0.11

It was our purpose to test types of materials and properties that affect soda resistance rather than compare competitive materials. Materials are identified by code rather than trade names. Many of the trials were made between 1947 and 1950, and improvements in some of the materials may have been made. Prices are not claimed to be perfectly correct or current, but give a rough idea of service life in relation to cost. Some minor variations in service life may have been caused by inevitable variations in technique and operating practice, but we believe the major differences are significant.

Rammed Linings. Service data for monolithic linings rammed densely around a form with a pneumatic rammer are shown in Table 2. Five basic ramming mixtures included a dolomite-magnesite mate-

rial *R*, magnesite *B* and *M*, a British dolomite *D*, and an American dolomite preparation *G* currently used successfully in basic cupolas. None of these materials lasted more than one day in which time attack at the slag line was 2½ to 4 in.

With basic linings desulphurization was much more effective because the lining consumed did not neutralize the sodium oxide like siliceous materials. From all indications, the soda ash addition could have been cut in half for equivalent sulphur removal with improved lining life. No doubt silicate binders in some of these materials decreased resistance. However, as received, basic materials appear to have no particular soda resistance, especially in view of their high cost.

Basic brick (dead burned magnesite) laid with magnesite mortar, likewise lasted only one day with 3-in. attack (Table 3).

A very high cost chrome plastic lasted only two days with 1-in. attack the first day and 2-in. after two days.

Several siliceous and clay plastics used in our plant for ladle lining, electric furnace hearths, etc. proved to have essentially no resistance to soda slags. Little was known about the soda resistance of many plastic refractories which were highly recommended for many applications. *LO* rammed nicely but was almost completely dissolved at the slag line the first day. High-quality plastic *KC* lasted 3 days before 2-in. attack seemed to warrant patching. It was immediately apparent that service of this material did not justify the cost.

NJ is the clay plastic with which we have had the most experience. This material had a fair reputation for soda resistance. On the first test the lining was eaten back ½-in. the first day, and 2 in. after the third day. It was then patched with 50 lb of material which lasted two days. A second test was run five days, before the 3-in. attack was patched with 60 lb of material. This patch lasted 3 days.

Plastics *SP* and *HB* turned out to be essentially competitive materials with composition and cost similar to *NJ*. *SP* lasted 4 days before a 2-in. attack was patched. *HB* lasted 5 days before a 3-in. corrosion was patched. Within the accuracy of our test procedure, these three materials were comparable in performance.

Ease of patching is one of the advantages of monolithic materials; however, shrinkage cracks create openings for slag attack and constitute the weakest spots of monolithic linings.

Clay-Graphite Plastics. The next class of materials tested was clay plastics containing finely dispersed graphite. Since graphite is completely resistant to slag attack and adherence (it is not wet by slags), its inclusion should logically improve slag resistance. The cost of these materials at nearly $80/ton is higher than the clay plastics discussed in the previous paragraph. A lining of *NC* ran 7 days although fine cracks developed very early. These cracks might be a more serious weakness in the "flats" of our large forehearth.

GX was in its development stage at the time of our test. A lining of this material sealed its surface too tightly. When heated at the usual rate, a ½-in. depth of refractory exploded or flaked from the surface. The lining was replaced after the first day. The material was corrected later, but this experience indicates the need for permeability and slow preheat when using rammed linings. *LT* lasted only 3 days, apparently because of deep cracks. *SG* lasted 4 days; although fairly solid, the graphite seemed to be burned away from the face of the refractory. Since this test, we understand this material has been greatly improved by more effectively stabilizing the graphite.

Plastic *HS* gave a life of 8 days—one of the longest lives obtained from rammed materials. The clay-graphite material rammed densely, shrinkage was only nominal, and graphite appeared reasonably well stabilized. The doubled life should justify cost where long continuous runs are necessary.

Silicon carbide brick has a reputation for resistance to chemical attack; but, as far as we know, material of this sort had never been tried in desulphurizing fore-

TABLE 2 . . PERFORMANCE OF RAMMED LININGS IN SMALL FOREHEARTH

Material	Cost $/ton*	Depth of Attack: 1st day in.	Depth of Attack: 3rd day in.	Patching: days till	Patching: depth in.	Patching: amt. lb.	Patching: lasted days
Basic Plastics							
Domomite-Magnesite -R-	90	3	——	1	3	——	——
Magnesite -B-	110	4	——	1	4	100	1
		4	——	1	4		
" -M-	82½	3	——	1	3	——	——
British Dolomite -D-	?	3	——	1	3	——	——
American Dolomite -G-	47½	2½	——	1	2½	——	——
Chrome Plastic -C-	190	1	——	2	2	——	——
Clay Plastics							
LO	(55)	4	——	1	4	——	——
KC	(120)	½	2	3	2	——	——
				5	3	60	3
NJ	54	½	2	3	2	50	2
SP	72	——	1¼	4	2	70	5
HB	76	——	¾	5	3	75	4
Graphite-Clay Plastics							
NC	(85)	cracks	——	7	3	——	——
GX	82	flaked off	——	1	——	——	——
LT	77	deep cracks ¼	——	3	——	——	——
SG	82	½	2½	4	3½	65	3
HS	82	——	1	8	3	90	7
Silicon Carbide -E-	(150)	½	1	8	2	75	4

*Costs are not perfectly accurate and are based on carload quantities without freight. Freight usually is about $10/ton to our plant and warehouse prices are usually at least 30% higher than indicated. Costs in parenthesis are very roughly estimated.

TABLE 3 . . PERFORMANCE OF BRICK LININGS IN SMALL FOREHEARTHS

Brick Type	Brick Cost ¢/brick*	Mortar Type	Mortar Cost $/ton	1st Day Attack Depth in. Brick	1st Day Attack Depth in. Joints	No. of Days Life
Magnesite	36	Magnesite	80	3		1
High-Al -A- Clay Brick	26	High-Al	100	¼	½-¾	4
HB	11½	MT	100	¼	¼	6
AO	14	SD	60	¼	½-1	3
VN	18½	MM	50	½	¼-¾	5
KK	21½	DJ	105	¼	¼-½	8
KK	21½	ST	105	¼	¼	12

Comparison Segments	Brick Cost ¢/brick*	Mortar Type	Mortar Cost $/ton	6-day Attack Brick	6-day Attack Joints	16-day Attack Brick	16-day Attack Joints
KK	21½			¼	——	1-1½	¼
VN	18	ST	105	½	¼-½	1½-2	¼-½
HB	11½			½	¼-¾	1½-2½	½-2
CN	11			¾	¼-½	1½-2½	¼-¾

Comparison Segments	Brick Cost ¢/brick*	Mortar Type	Mortar Cost $/ton	8-Day Attack Brick	8-Day Attack Joints
		ST	105	1-1½	½-1½
HB	11½	MT	100	1-2	½-2
		ML	99	1½-2	1-2

*Costs are not perfectly accurate and are based on carload quantities without freight. Freight to our plant is usually $10/ton and warehouse prices are usually 30% higher than indicated.

Thorough drying of lined spout is accomplished with gas torch.

Six-ton desulphurizing forehearth handling 40 tons iron per hour was found to give most economical service when lined with dense clay brick.

hearths. A silicon carbide ramming mixture in the top half of the forehearth was consumed ½-in. the first day, 1 in. after 3 days, and ran 8 days before a 2-in. consumption required patching. Adherence of patches to the fired lining did not appear as good as for clay materials—a 75-lb patch lasted only 4 days. The life of the first lining was the best of any rammed material, but patching was not as successful. If this material could be confined to a small area subjected to concentrated attack its cost might easily be justified.

Drying and Preheating

Drying and preheating of all plastic linings influences the performance of the material. Our preferred practice includes two or more days air drying, one day with a low gas torch gradually increased, and one day at red heat from air-gas torches. Preheating several hours above a red heat is necessary to drive off the combined water in the clay. Many circumstances make it necessary to shorten this drying and preheating schedule.

Moisture content is very important in plastic materials and has considerable effect on service life. High moisture materials appear to work well, but have higher shrinkage and greater tendency to crack.

Brick Linings. Table 3 gives performance data for a number of brick linings. The early failure of basic magnesite brick has already been described. A high-alumina brick (70% Al_2O_3) lining was put up with a high-alumina mortar. The high fusion properties of these materials were not needed in the forehearth, but this was considered a good material to test the soda resistance of higher alumina materials. The first day ¼-in. of the brick face was consumed, the joints had been eaten back ½ to ¾ in. deeper. Typical of brick linings, the corners of the brick were eaten away as the attack penetrated the opening joints. After four days the lining was like a saw tooth at the slag line with the points of the brick offset about 1½ in. and the valleys penetrating another 1½ in. The lining was renewed (replaced except 4½-in. section against the shell) after 4 days. Performance was not as good as some lower alumina, denser brick.

Five different clay brick with significant differences in properties were used in complete linings and laid with five different mortars. Very resistant brick will protect the mortar to some extent. On the other hand the resistance of the mortar and the fit of the brick hasten brick attack when joints become open. *HB*, a 11½¢ brick, was laid with *MT* mortar ($100 ton). Brick consumption the first day was ¼ in.; joints were another ¼ in. deeper. The lining lasted 6 days.

Brick Laying Practice

The next combination was a super-duty brick *AO* laid with super-duty clay as mortar. As a result of the ineffective mortar the combination lasted only 3 days. Some rather thick joints on this lining indicated the brick were not as efficiently laid as usual. In later tests this brick lasted much longer with a better mortar and tighter fit.

VN was laid with an ordinary $50 mortar that proved to have poor slag resistance. The brick face was consumed only ⅛ in. the first day (less than *HB* and *AO* brick) but the joints were eaten to ¼ to ¾ in. depth. Lining life was five days, apparently cut short by weak mortar.

The next lining was of *KK* brick, a high-fired, very dense brick costing 21½¢ each. The mortar was a $105/ton product with reportedly good resistance to soda slags. Both the brick and the mortar appeared superior to any tried. The life of the combination was 8 days. Another lining of the same brick was laid with mortar *ST*. This mortar appeared still better and the lining lasted 12 days—one of the longest runs.

Composite Brick Linings. Because brick performance differs due to variations in mortars and desulphurizing procedures one quarter sections of a lining were made up with four different brick using the same good mortar and same technique on all. This lining ran 6 days before attacked enough for comparative measurements. *KK* brick showed the least attack of ¼ in. with no penetration of joints. *VN* and *HB* brick were apparently equal with brick faces offset ½ in. Joint penetration on *VN* brick ranged from ¼ to ½ in. and on *HB* brick ¼ to ¾ in. *CN* brick was attacked slightly more than the others, but its cost was lowest.

This lining ran 16 days before it was declared unsafe for further use. *KK* retained its superiority especially in protection of the joints. *VN* seemed to establish itself in second place with some superiority over *HB*. Some of the joints of *HB* opened up fast the last few days causing the lining to be condemned. With the exception of a couple of deep joints, *CN* appeared equally or slightly more consumed than *HB*. Figure 1 is a sketch of this lining at the end of its service life.

Soda Resistant Mortars

A similar comparison was made of three mortars that appeared to be among the best for soda resistance. *HB* brick with only moderate resistance was used and joints were purposely made thicker than usual to place more than the usual dependence on the mortar. Mortars *ST*, *MT*, and *ML* were used in one-third sections around the circumference. This lining lasted only 8 days compared to 16 days for the brick test, showing the importance of joint thickness and brick laying technique. The lining with thin tight joints lasted twice as long as the lining of which joints were intentionally made thicker.

Porosity-Life Correlation

All three mortars showed good resistance to soda with no significant difference among them. Laying technique appears more important than any difference between the three, which turned out to be competitive materials of similar composition and price, produced by three different manufacturers.

TABLE 4 . . PROPERTIES OF BRICK
(in order of decreasing performance)

Brick	Al_2O_3 %	Porosity %	9-in. ST Weight lb.	9-in. ST Cost ¢
KK	44	9-12	8.1	21½
VN	42	12-15	8.2	18½
AO	42	13-16	8.2	14
HB	38	14-17	7.8	11½
High-Al	70	24-28	8.6	26
CN	39	21-25	7.2	11

The six clay brick and properties were arranged in Table 4 in

the apparent order of service life to determine which properties contribute most to soda resistance. Service life is not improved by higher alumina content per se. Weight is not a true indication of porosity since the higher aluminum compositions can weigh more, even with higher porosity. The property that showed the best correlation was porosity.

The best resistance to soda was experienced on a brick with 9-12 per cent porosity and the poorest records were obtained on bricks with porosity values over 20 per cent. This checks general experiences. The best resistor of soda seems to be a dense refractory face. In plastic linings, soda attack proceeds rapidly in shrinkage cracks and soft, porous spots. In brick linings, attack proceeds readily in joints and in brick pores.

Many of the higher cost, high-quality brick have properties improved for thermal shock or higher temperature resistance and are not necessarily more resistant to soda slags. Some of the lower cost clay brick (not tested) with inferior refractoriness but lower porosity might show equal or better resistance at lower overall cost than some of the medium priced brick tested.

Large Forehearth. Table 5 shows the performance of five materials used in the large forehearth ladle. This ladle is link shaped with a total lining of 10 in., holds about 6 tons of metal, and receives around 35-40 tons/hr for two shifts or a total of 550-700 tons per 16-20-hr day.

TABLE 5 . . DATA FOR LARGE FOREHEARTH

	Soda Ash	Lining Life*		
Lining Material	lb/ton	shift	hr	ton
1948				
Clay plastic NJ	5	6+	54	(1650)
" " SP	5	6—	54	(1650)
Clay-graphite HS	5	8	80	2700
1954				
Clay plastic NJ	3	8	80	2840
	3	10	90	3060
	3	12—	108	3720
	3	6	54	1800[a]
	3	10—	90	2918
Clay-graphite GX	3	6	54	1800[b]
	3	10+	90	3000
Clay brick KK	2½	14	126	4266

* (+) Means better than average condition, (—) means worse than average when removed. Values in parentheses are estimated
[a]Rammed too long.
[b]Too wet as received.

In 1948 clay plastics *NJ* and *SP* lasted 3 days or 6 shifts, 54 total hours, and about 1650 tons of metal treated. The points of greatest attack were shrinkage cracks that developed, especially in the flat areas of the link shape.

Clay-graphite plastic *HS* tried at the same time had a life of 4 days. This was 30 per cent better than the clay plastic, but material cost was higher than this difference. Shrinkage cracks likewise contributed to the failure of this material.

Moisture in all plastics, as received, was considered higher than necessary. Remixing the clay plastic with an addition of 10 per cent ganister reduced the cracking tendency considerably and improved the life.

Optimum Moisture

By 1954 this improvement plus some reduction in soda ash additions enabled the same clay plastic *NJ* to last an average of 4 to 5 double-shift days. One lining lasted only 3 days or 6 nine-hour shifts for 1800 tons of metal. However, this lining had been rammed several months previously and might have reabsorbed moisture, contributing to its premature failure. One lining lasted 12 nine-hour shifts for 3720 tons. On page 60 is a sketch of this large ladle at the end of a typical campaign.

Clay-Graphite Plastic *GX* was tried for two linings. The first time the material was rammed as received and moisture was obviously higher than necessary and advisable. It cracked excessively while preheating. Life was only 6 nine-hour shifts for 1800 tons. Failure was due to attack in the shrinkage cracks.

For the next lining, blocks of material were shredded, allowed to lose some moisture, and then mulled before use. Cracking tendency was greatly reduced. The lining lasted 10 nine-hour shifts for 3000 tons of metal. It was in better than average condition but was removed on the week end. Failure was still in the cracks that developed in the flat sections of the link shape.

In this forehearth, the clay-graphite material appears to give possibly 10 to 20 per cent better life. This is not as much superiority as shown on the small forehearth. In the large forehearth cracking tendency is more serious, while on the small forehearth chemical attack is more severe. Since clay-graphite plastics seem to have better chemical resistance than crack resistance this seems to explain the difference in relative performance.

Complete data are available on only one brick lining in the large forehearth, other tests are in process.

Comparative Costs of four typical small forehearth refractory materials are shown in Table 6. The least expensive original lining was rammed clay plastic for $28.50. A lining of clay-graphite plastic cost $37. On a brick lining, using 9¢ brick, material cost was lower, but labor costs were much higher than for plastic; total cost was $34.50. Higher cost, denser brick raised the lining cost to $43.50. Operating slightly lower soda ash consumption during this period.

TABLE 6 . . SMALL FOREHEARTH - COMPARATIVE LINING COSTS*

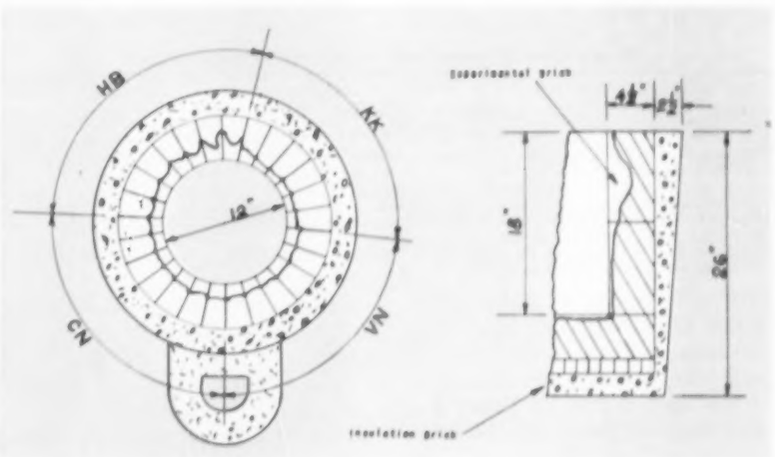
		Cost of Lining in $			Patch	32-Day Period	
Material	Unit Cost	Material	Labor	Total	Cost	Linings	Cost
Clay plastic-NJ-	$63/ton[a]	18.90	9.60	28.50	5.00	one + 10 patches	$78.50
Clay graphite-HS-	$92/ton[b]	27.40	9.60	37.00	7.50	one + 5 patches	$74.50
Reg. clay brick-HB-	9¢ ea.	12.00	22.50	34.50	Reline	4 linings	$138.00
Dense brick-KK-	21½¢ ea.	21.00	22.50	43.50	Reline	4 linings	$87.00

*Ram labor: 6 hr medium labor, approximately 600 lb material. Brick labor: 6 hr skilled + 6 hr helper, 75 brick + mortar + spout.
[a]$54 base + $9/ton freight.
[b]$82 base + $10/ton freight.

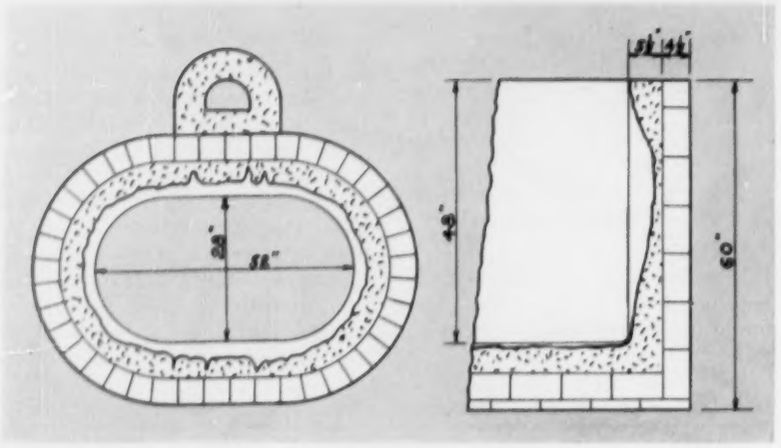
The replaceable section of the lining was made up with arches of high-density brick *KK* spaced very closely and very carefully with *ST* mortar. With some repair to the tunnel of the spout, this lining lasted 14 shifts, 126 hr, and 4266 tons of metal. When removed most of the lining was still in good condition, but in several joints the saw tooth attack reached 2 to 3 in. Our brick layings seem more inclined to fail in such weak spots. This is the longest life and highest tonnage of any lining, but records indicate cost depends upon service life, however, and a period of 32 days was selected for cost comparison.

With a plastic lining, the small forehearth can be patched easily on alternate days with about 60 lb of material and 2 hr of unskilled labor. A rammed clay plastic lining with 10 patches will serve for 32 days at a total cost of $78.50.

Longer life of clay-graphite plastic in this forehearth appears to justify its higher cost. One lining plus 5 patches could be expected to give 32 days service for a cost of



Low porosity brick showed the least attack in the 500-lb desulphurizing forehearth lined alike in quarter sections with four different brick.



A clay plastic monolithic lining in the 6-ton forehearth lasted 12 nine hour shifts for 3720 tons. Sketch shows the end of a typical campaign.

$74.50, which is 5 per cent cheaper than the clay plastic.

Brick linings could not be patched and had to be renewed completely. Regular clay brick was estimated to require 4 linings with an average life of 8 days, making the 32-day cost $138. Higher cost, dense brick, lasting 16 days, reduced the over-all cost to $87 for 32 days. If it were not easy to alternate ladles and patch at any time, longer life would be more of an economic advantage, and the cost picture might be considerably different. A little lost production or week-end work will buy a lot of refractory.

Cost Picture Reversed. Relative costs for the large forehearth (Table 7) are reversed and some brick linings are cheaper. Brick require over twice the labor, more highly skilled labor, and more careful supervision; however, lower material costs overcome the labor difference.

The back 4½ in. of lining is a brick back-up lining that does not have to be replaced as it out lasts several inner linings. This back-up lining costs $195 or $6.50 per day for a 30 day life.

Regular low-porosity clay brick give the cheapest original lining of $165.50. Extra dense brick cost $252.50, clay plastic $227.40, and clay-graphite plastic $314.40.

When performance is considered, some of the more expensive linings show a lower cost per day or per ton.

A lining of clay plastic with a life of 4 days costs $63.35 per day. Clay graphite with a life of 5 days costs $69.38 per day. On this particular large ladle, the higher cost of clay graphite was not justified as it was on the small forehearth.

Due to its long life of 7 days, dense brick lining proved cheaper with a daily cost of $36. However, soda ash addition was not quite as heavy during this test. More soda ash might have reduced the life one day and reduced the cost difference.

Actually, in our plant, the large forehearth can be changed much more easily on week ends. For that reason one additional day to fall on a week end is worth much more than an additional day or two beyond a week end. This was not considered in the cost since it is peculiar to conditions on this cupola.

TABLE 7 . . LARGE FOREHEARTH - COMPARATIVE LINING COSTS

Material	Unit Cost	$ Cost of Lining[a] Material	Labor	Total	Life Expected	Cost[b] Per Day
Clay plastic-NJ-	$54 + $9/ton	189.00	38.40	227.40	4 days	$63.35
Clay-Graphite plastic-GX-	$83 + $9/ton	276.00	38.40	314.40	5 days	$69.38
Reg. Clay brick-S-	9¢ ea.	61.50	104.00	165.50	——	——
Dense clay brick-KK-	21½¢ ea.	128.50	124.00	252.50[c]	7 days	$36.00

[a]Plastic 24 hr medium labor, 6000 lb material. Brick 24 hr skilled labor + 32 hr medium labor, 400 brick, 200 lb mortar + spout.
[b]Cost includes $6.50 per day for $195, 4½-in. brick back-up section estimated to last 30 days.
[c]Includes cost of one repair to tunnel.

Advice on Desulphurizing Ladle Linings

1. Regardless of form or composition, no material was found to completely resist soda slags. Longest single runs of 8 to 16 days on the small forehearth were obtained with low-porosity clay brick, one of three special mortars, and put up with tight joints.

2. Brick linings loosely put up with ordinary mortar or mud, with poorly fitting shapes, give very short life because of corrosion in large joints dislodging whole brick. On the other hand, carefully fitted brick linings with minimum joint space have good life. Mortar and fitting technique can over-shadow material variables.

3. Brick forehearths cannot be patched satisfactorily without removal of a complete layer of brick and rebuilding at the slag line. Brick linings tend to fail more abruptly than rammed linings if allowed to run till near failure.

4. Whereas some clay plastics hardly last one day, three clay plastics lasted 4 and 5 days before patching was required. Principal advantage of rammed materials is the low cost of their less skilled application and the ease with which they can be patched. On the small forehearth where it is easy to patch, overall costs are the best with monolithic linings. Plastics should be used with minimum moisture, and rammed densely and carefully. High density and freedom from cracks are necessary for soda resistance. Slow drying and high preheating of rammed linings are best.

5. Special clay plastics containing graphite last nearly twice as long as straight clay plastics against heavy soda slag in the small forehearth. One material lasted 8 days; another—7 days. The higher cost of these materials is justified by longer service life. On the large forehearth, shrinkage cracks are the principal weakness of plastics, and reduce the advantage of the graphite.

6. A monolithic, silicon carbide lining gives the best life of any rammed material, but the cost is one of the highest for monolithic materials and patching is difficult. However, this material could be used profitably in a limited area where attack is concentrated.

7. Contrary to general belief that basic materials resist basic soda slag, we find both basic brick and five basic ramming mixtures inferior to the better clay plastics. Although consumed basic refractory does not reduce desulphurizing efficiency like the acid refractories, none of the basic materials lasts any longer.

8. A chrome plastic of high cost failed to show superiority.

9. Comparison of the performance of clay brick types with their properties indicates that many high-alumina, or super-duty refractories, from the standpoint of high refractoriness, do not show improved soda resistance proportional to cost. High density or low porosity seems to be the most valuable property and more important than chemical composition.

10. There appears to be no one best material for lining desulphurizing ladles. Choice depends on operating factors.

Clay plastics of high density and moderately low cost are the easiest to apply and patch with unskilled labor and little supervision. They give only moderate life but low over-all cost where forehearths may be changed or alternated with no difficulty.

Clay-graphite and silicon carbide plastic give a longer life but at a much higher material cost which may be justified where freedom from interruption is very important.

The longest life without interruption was obtained with clay brick of low porosity, closely fitted, and layed with special mortars. Skilled labor and closer supervision are required, but overall costs appear good.

Largest Held in Europe . . .

1955 International Foundry Congress

Yngve Granstrom (right), president of the International Committee of Foundry Associations, presenting award of Honor to V. C. Faulkner.

■ **More than a thousand** delegates from 16 countries plus British Commonwealth delegations gathered in London late in June for the largest International Foundry Congress ever held in Europe.

The Congress opened June 19 with a garden party and ended June 25, with an all-day excursion to Blenheim Palace and Oxford. But in between these social events delegates worked hard and attended some unusual technical sessions. Following the Congress, delegates and their wives took part in post-congress tours to British industrial centers.

Dr. A. B. Everest was elected president of the Institute of British Foundrymen who acted as hosts to the international gathering held simultaneously with the IBF annual meeting. H. J. V. Williams was elected senior vice-president and J. Blakiston was named junior vice-president.

The first John Bell Traveling Scholarship was awarded to David Moffat Clinton. Other IBF honors were: E. J. Fox medal, L. B. Pfeil; Oliver Stubbs medal, E. S. Renshaw; British foundry medal and prize, John M. Langham; and Meritorious Services medal, John G. Bailes.

V. C. Faulkner, editor of *Foundry Trade Journal*, was given the Award of Honor of the International Committee.

The official exchange paper from the American Foundrymen's Society to the Institute of British Foundrymen was authored by Hiram Brown.

Walter R. Jaeschke, consulting metallurgical engineer of Whiting Corp., was the American delegate and the only representative from the United States to attend the congress. Much of the information contained in this report comes from Mr. Jaeschke.

■ The International Committee meeting on testing cast iron was primarily concerned with a standard test bar. However, much work had been done toward trying to write specifications for gray irons. Because of the complexity of the problem the committee may decide only on a test bar suitable for reporting research work on a common basis.

■ The Dictionary Committee has recently published its first provisional edition of foundry terms relating to melting. The committee asks for constructive criticism of the first edition.

■ The Committee on Foundry Defects has recently produced its revised handbook and copies have been mailed to members. Members of the committee expressed surprise to learn that in the United States the foundry defects handbook had been used by competitive industries as an argument with customers against the use of castings.

■ Application of membership for Austria was deferred until the two groups requesting membership decide which organization is entitled to membership in the International Committee.

■ **Congress business.** The 1956 Congress will be held in Dusseldorf, Germany, in September and will be accompanied by an equipment exhibit. Other dates for congresses are: 1957 in Sweden; 1958 in Belgium; 1959 tentatively in Spain; 1960 tentatively in Switzerland. Switzerland will have the privelege of electing the president for 1956 and Great Britain the vice-president. G. Lambert was re-elected secretary.

Dr. A. B. Everest (right), new president of the Institute of British Foundrymen, at international reception with Mrs. Everest and Walter R. Jaeschke, U.S. delegate, who will present 1956 exchange paper from AFS.

At the official adjournment of the Congress, many delegates chose to tour foundries in Britain. Two tours were organized, one to visit Birmingham, Nottingham and Manchester, the second to visit Glasgow, Edinburgh, Newcastle, and Sheffield. Mr. Jaeschke chose Tour No. 1. On Monday he visited the Tame Bridge Foundry of W. T. Avery, Ltd.

"Avery's new foundry has emphasis on high roof construction good ventilation and good light, Mr. Jaeschke said. Most of the foundries visited had many skylights. Windows were clean and natural light was depended on almost exclusively during the day.

"Castings had excellent finish. Flask and pattern equipment was of the best order. Slingers were used almost exclusively in this foundry.

"On June 28 our group visited Midland Manufacturing Co., manufacturers of switch and motor control gear. It is well-mechanized for light electrical castings. Power squeeze molding machines were

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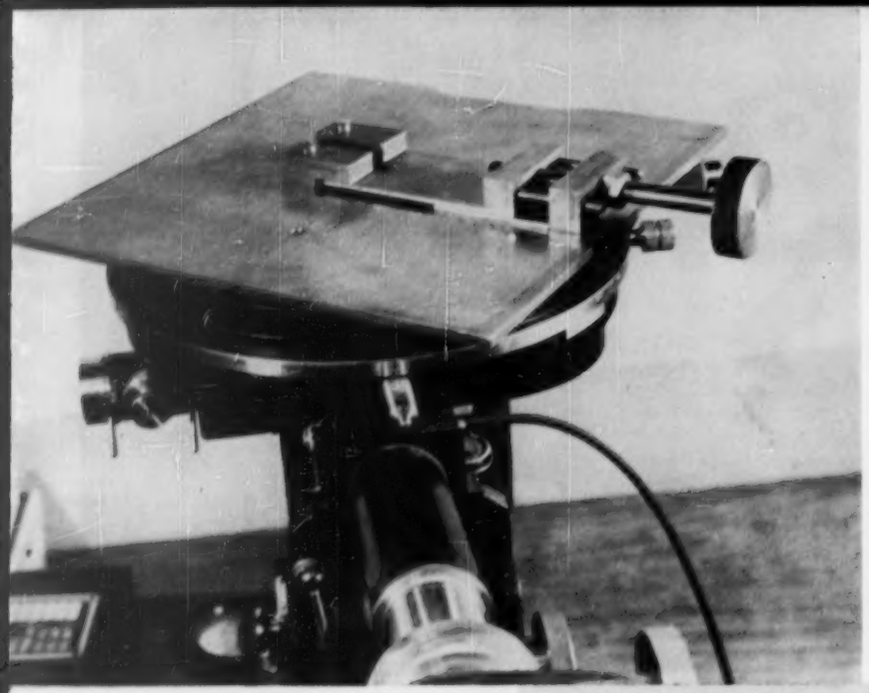


Simple Equipment Opens Research Door

Microscope, microbend tester, and polished metal strip combine to give new tool for studying flow and fracture of metals

RICHARD A. FLINN / *Professor*
Chemical & Metallurgical Engineering
University of Michigan, Ann Arbor

PAUL K. TROJAN / *Graduate Student*
Metallurgical Engineering
University of Michigan

Fig. 1a . . Side-of-beam microbend tester set on microscope.

■ Microstructure of a metal is the fundamental variable determining mechanical properties metallurgists agree. The mechanical engineer is prone to select some favorite measurement such as hardness as an index not only of tensile strength but also of wear resistance, endurance limit, and often service performance.

One of the weaknesses of the metallurgical point of view has been the scarcity of information on just how the microstructure determines properties. It is of course common practice to perform a group of tensile tests on a selected set of microstructures and after the tests are complete to correlate structure with performance.

This is a postmortem examination--the actual contributions of the individual microconstituents to flow and fracture mechanisms are often hard to deduce. Even if a cross section of the tensile fracture is examined metallographically the probability of finding the zone where fracture initiated is very small. Furthermore the post-fracture metallographic examination can miss much of the evidence that would have been available if continuous observation of the microstructure during deformation could have been performed.

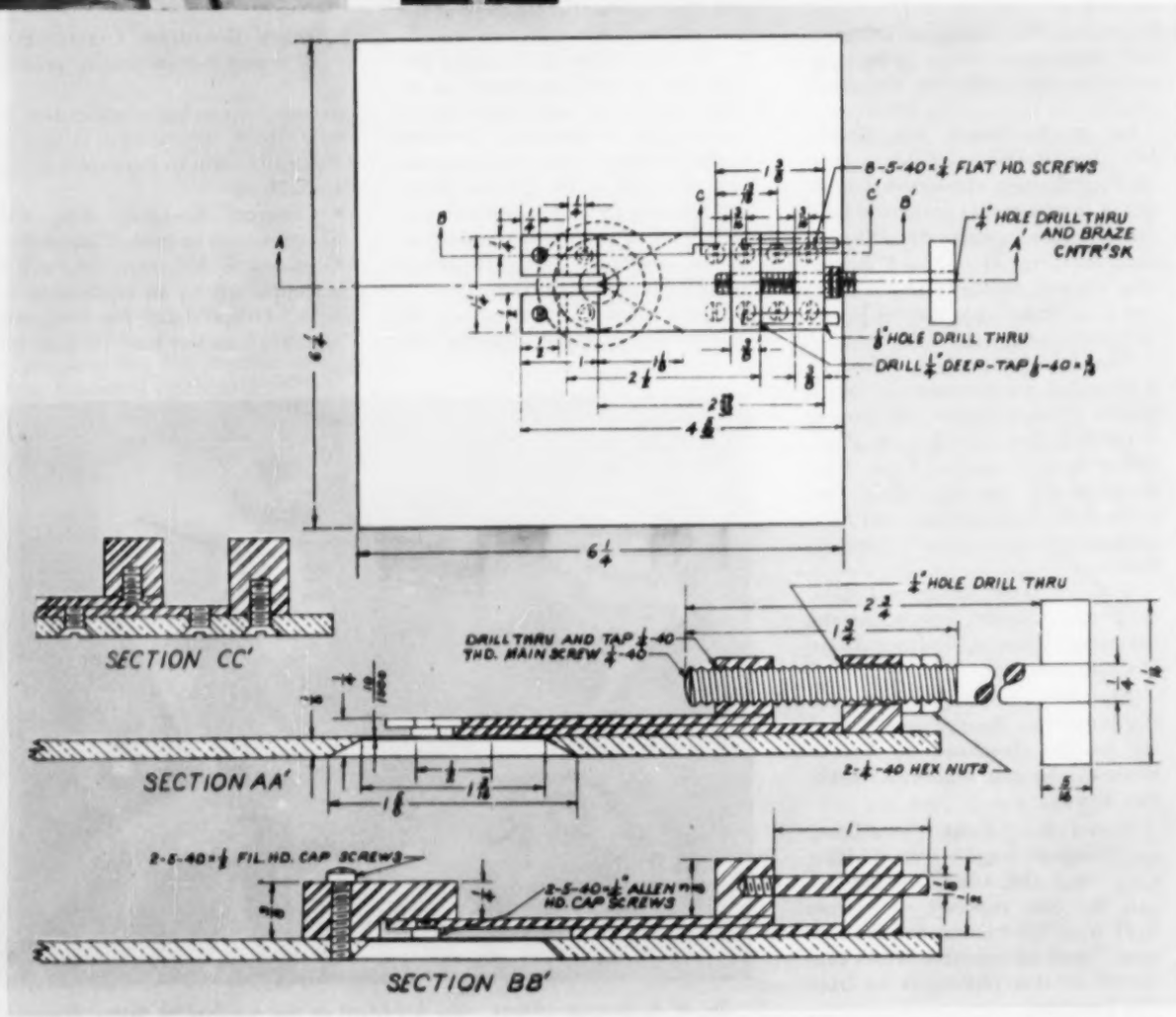

8-5-40×¼ FLAT HD. SCREWS
¼" HOLE DRILL THRU AND BRAZE CNTR'SK
⅛" HOLE DRILL THRU
DRILL ½" DEEP-TAP ⅜-40×⅜
6¼
SECTION CC'
½" HOLE DRILL THRU
DRILL THRU AND TAP ⅜-40 THD. MAIN SCREW ⅜-40
2-⅜-40 HEX NUTS
SECTION AA'
2-5-40×¼ FIL HD. CAP SCREWS
2-5-40×¼" ALLEN HD. CAP SCREWS
SECTION BB'

Fig. 1b . . To avoid displacement of the areas of maximum stress, the center support is kept stationary and the load is applied to the ends by turning the thumbscrew which pulls the plate with two claws.

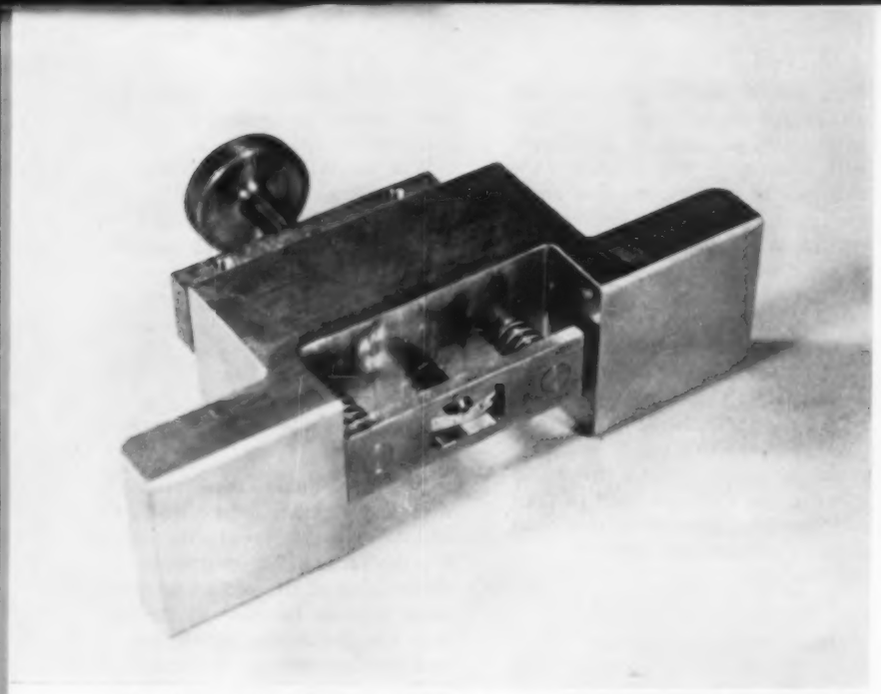


Fig. 2a . . The bottom-of-beam microbend tester is used to view the first manifestations of slip in rather brittle and some ductile alloys.

Finally, the performance of the more complex microstructures such as mixtures of massive carbide, graphite, austenite and its transformation products is difficult to evaluate from the examination of fractures or the grosser methods such as the usual tensile, compressive, and other relatively large scale tests.

For these reasons it seemed desirable to develop a method for the metallographic observation of a specimen under stress. An obvious starting point is to prepare a thin specimen with a metallographic surface and pull it in direct tension. This was done by one of the authors a number of years ago and the difficulties were the well known internal fracture in tension as well as the inability to predict the proper area for observation as the fracture proceeded to the surface.

Recently, it was decided to try a bending technique so that the area of maximum stress would be known and be at the surface, and also that the effects of different levels of stress could be observed at the same time in progressing from the surface of maximum tension to the neutral axis. This is called the side-of-beam observation.

As a companion test another apparatus was built to permit complete observation of the area of maximum tension, to be described as the bottom-of-beam test.

Preparation of Specimens. To permit maximum flexibility of specimen selection from interesting regions such as welds and special surfaces, and for easy polishing, a small specimen size was used: 1 x 1/16 x 1/16 in. In general these samples are prepared by milling 1/16-in. square strips from the desired specimen and cutting to length. For harder materials the specimens are sectioned with a well-cooled abrasive cut off wheel and then surface ground to size.

After this rough preparation the specimens are mounted in thermosetting resin, and polished metallographically by the usual sequence of grinding papers, finishing with diamond dust of 1 micron size. The plastic mount is then broken away from the specimens, and the specimens are inserted in the bend test apparatus.

If desired, the usual etchants may be used. In many cases it is desirable to use an unetched speciman since the development of true slip bands (not etch bands) is more easily observed. Other structures are readily developed by their difference in elastic and plastic behavior.

Two different bend testers have been devloped, called for convenient reference the "side-of-beam" and "bottom-of-beam" observations (Fig. 1 and 2).

Side-of-Beam Observation provides for observing the stress gradient on the side of a beam which is supported at the ends and loaded at the center. The stress varies continuously from maximum tension at the bottom surface to zero at the neutral axis, then to compression at the top surface. Photomicrographs of these regions are shown in Fig. 3 through 9. The relative deformation of the metal caused by the stress pattern is clearly evident.

Figure 1 shows how the test works. To avoid displacement of the areas of maximum stress the center support is kept stationary and the load is applied by moving the ends. This is accomplished by turning the thumbscrew which pulls the plate with the two claws against the specimen ends. The two guide blocks and the guide pins attached to the screw mechanism provide good alignment and avoid side thrust.

To conduct a test, the specimen is inserted in the apparatus with the polished surface toward the microscope objective. The assembly is

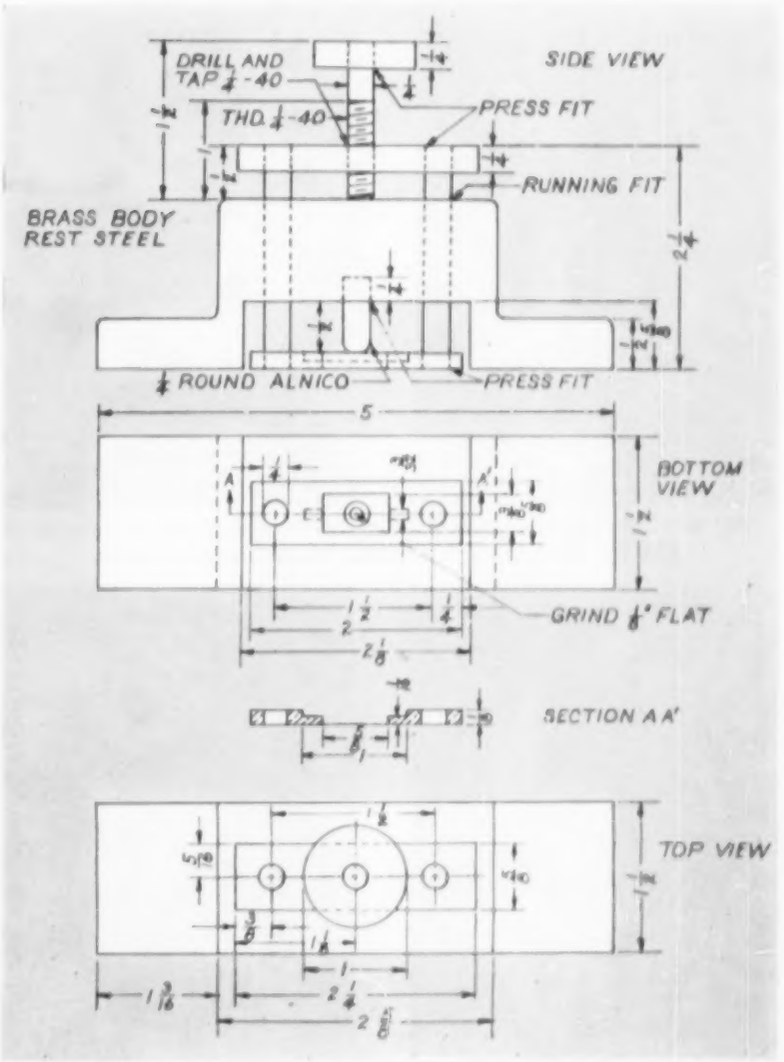


Fig. 2b . . This tester is being instrumented for quantitative measure of surface stress and to allow rapid cyclic loading study.

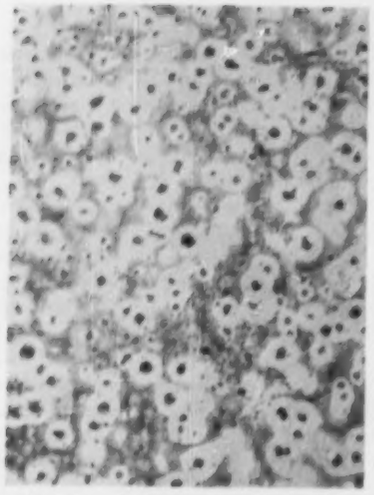
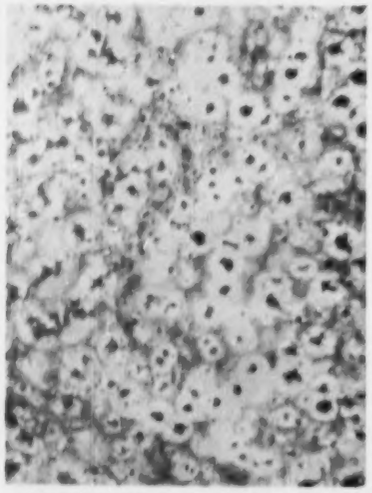


Fig. 3 . . Etched specimen in side-of-beam test under light load. a . . X50. b . . Slip starts on tension side near graphite, X250.



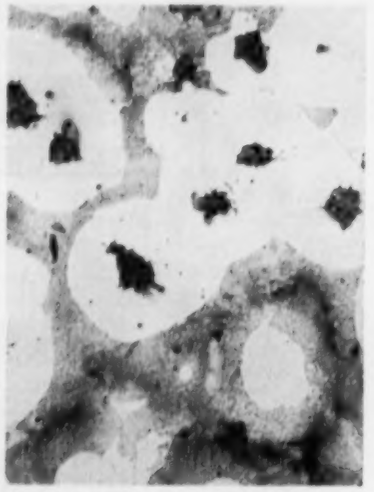
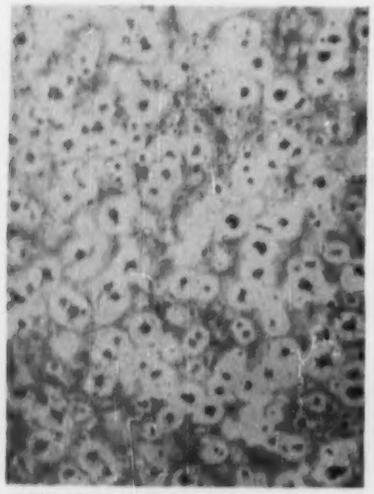


Fig. 3c . . Intermediate load produces flow in tension and compression, X50. Fig. 3d . . Slip in ferrite areas, none in pearlite, X250.



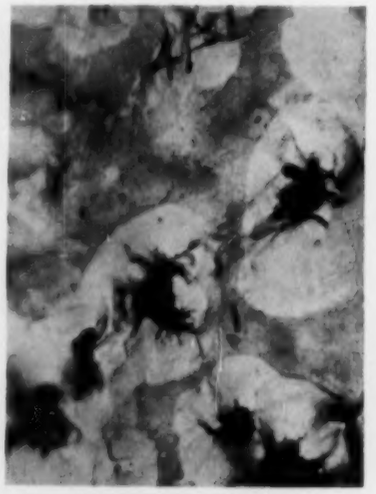


Fig. 3e . . Under heavy load there is severe deformation at both sides, X50. Fig. 3b . . Pearlite flows only in path of crack, X250.

then placed on the stage of any metallurgical microscope. It may be fastened to the stage, if desired, with a clamp or with a small screw to fit one of the tapped holes which are generally provided for the post which holds the usual metallographic specimen in place.

There is no stress between the microbend tester and the stage other than the dead load but clamping is usually advisable to avoid accidental jarring and the nuisance of relocating the field of observation. The micrometer screws of the microscope which govern the movement of the stage are used in their ordinary way to move desired areas of the specimen into view.

The specimen is bent by turning the thumbscrew while the operator observes the deformation.

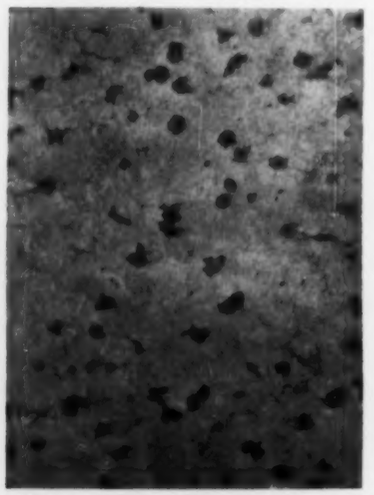
The behavior of a specimen of iron (average analysis 3.6% TC, 2.5% Si, 0.30% Mn, 0.03% P, 0.01%S, 0.06% Mg) containing pearlite, ferrite and spheroidal graphite is illustrated in Fig. 3. The photomicrographs at 50 diameters magnification illustrate the stress pattern across the bar while those at 250 diameters show the slip and fracture. Discussion of these results is given later.

Bottom-of-Beam Observation. In the case of rather brittle materials and occasionally for ductile alloys it is desirable to concentrate on the observation of the surface of maximum tension. In this way the very first manifestations of slip, flow, and fracture can be observed. The bottom-of-beam test is used in this instance (Fig. 2).

The first point to notice is that the axis of the loading screw and hence the direction of stress is at 90° to that used for the side-of-beam observation. In this way the observer is looking up via the optical system of the microscope at the bottom of the beam.

Here, again to avoid displacement of the area of maxmium stress the ends of the beam are moved rather than the center. This is accomplished by pulling up on the ends via screw and guides while the center is prevented from movement

Fig. 4 . . Slightly deformed area was 0.010 in. from fracture.



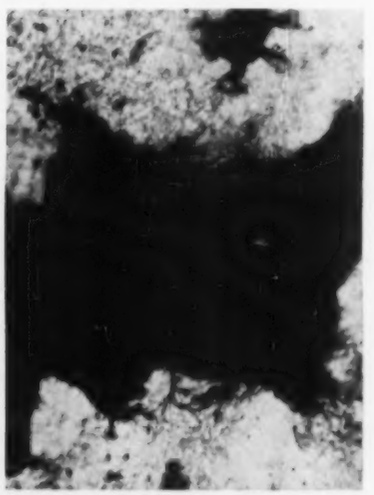


Fig. 5a . . Bainite spheroidal graphite at 620 F after austenitizing at 1600 F, X50. Fig. 5b . . Fracture shows slip of bainite, X250.

Fig. 6 . . Areas near crack develop fresh martensite, X250.

Fig. 7 . . Practically no deformation occurs in pearlite, X250.

Fig. 8 . . Graphite and ferrite; many cracks near fracture, X35.

highly stressed areas adjacent to the crack develop fresh martensite.

Conclusions. The microbend test has been developed to permit the direct microscopic observation of the flow and fracture of different microstructures.

In addition to use as a research tool it is believed that the results of these tests will give the design engineer a deeper insight into the effects of microstructures upon performance.

Acknowledgment. The authors wish to thank Professor Walter Pierce and C. M. Hammond for their skillful assistance and many contributions to this investigation.

by the center post. A magnet is employed here to prevent fragments of ferromagnetic materials from dropping on the microscope lens.

A further precaution against damage is the design of the specimen holder—the specimen cannot fall through the bottom observation slot. The base of the apparatus is sufficiently massive so that no clamping to the microscope table has been found necessary. The same specimen design and preparation techniques are used as in the side-of-beam test. If it is desired to avoid the stress concentrations at the bottom corner edges which can occur in plastic flow, they may be rounded. This provides a narrower

This bottom-of-beam method is being instrumented to provide a quantitative measure of surface stress as well as allowing for rapid cyclic loading for fatigue investigations. Motion picture recording is also under study. Load cells for measuring actual stresses at the center of the bar are being built.

These techniques are being applied to the observations of the behavior of microstructures under stress in a variety of cases including surface finishes such as plating, carburizing, nitriding, phosphate coating, phase transformation such as the martensite reaction, the initiation of fatigue cracks, the brittle region in certain welds, stress concentrations, and the general problem of the effect of the size, shape, distribution, amount and nature of a second phase in the matrix of the first phase.

To demonstrate some of the results obtained in the general study of a mixture of several phases, the behavior of ductile cast iron with a variety of matrices is illustrated in Fig. 3-8.

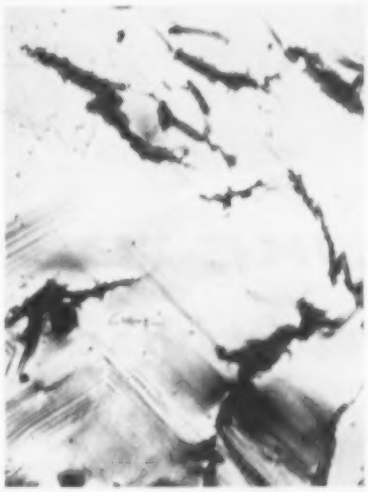
▪ Spheroidal Graphite, Ferrite, Pearlite. Ductile iron with ferrite "bulls-eyes" around the spheroidal graphite and with a pearlitic matrix is shown in Fig. 3.

In the first set of photomicrographs at 50 and 250 diameters the shape of the graphite is evidently the same across the bar which was cut from a 1-in. plate section. As the test progresses the 50X pictures show the distortion of the graphite on both the tension and compression sides of the bar while the absence of stress at the neutral axis is evident.

The 250X observations indicate that a very great amount of slip takes place in the ferritic areas even though they are separated by pearlite barriers. Practically no slip is visible in the pearlite until rupture takes place in the ferrite as shown in the final highly strained structure.

▪ Spheroidal Graphite, Pearlite This specimen (Fig. 4) offers an interesting contrast to the previous one. The few scattered pools of ferrite show the only indications of slip and rupture takes place with very little elongation.

▪ Spheroidal Graphite, Austenite, Martensite The specimen in Fig. 6 was alloyed with 18 per cent nickel to provide an *Ms* point just above ambient temperature. The



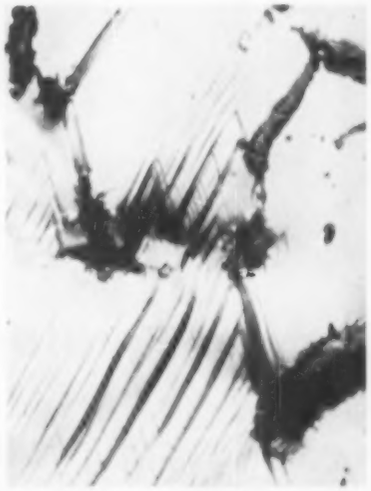
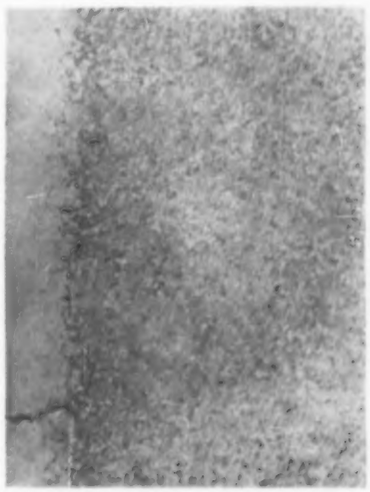


Fig. 9a . . Bottom-of-beam test, graphite-austenite, moderate load; note crossed slip lines, X100. Fig. 9b . . Flake fracture, X250.



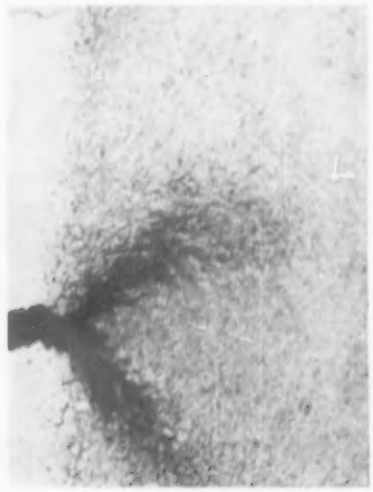
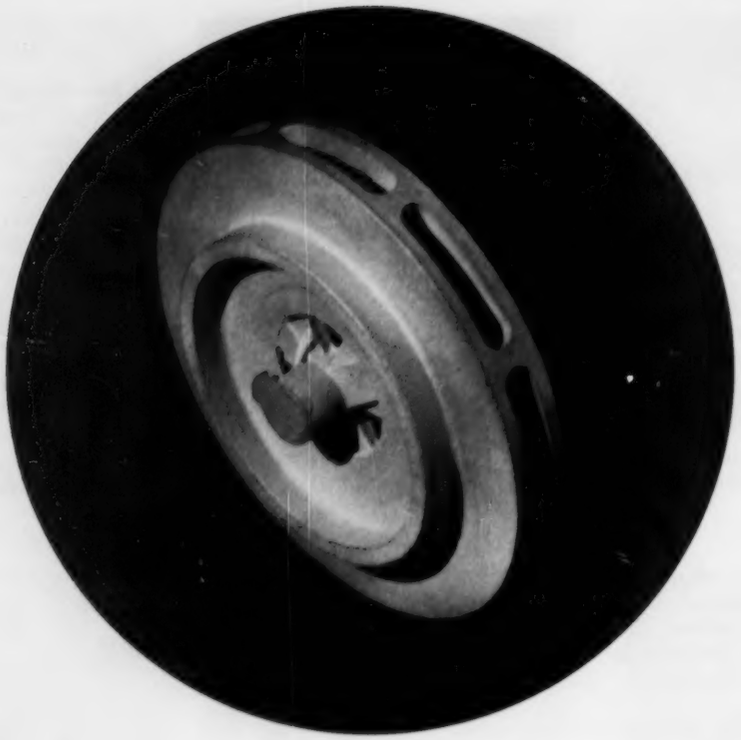
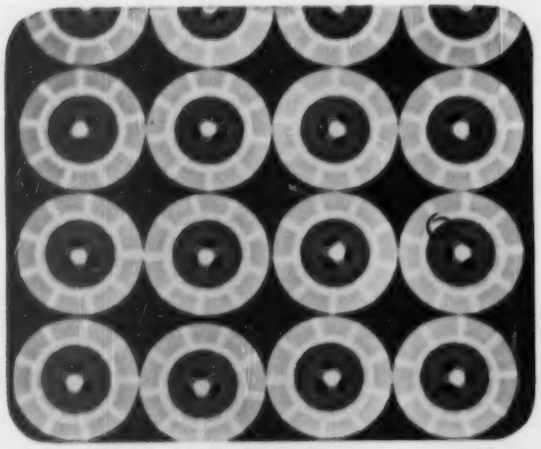


Fig. 10a . . Side-of-beam test, carburized 1020 steel, X50; light load cracks case. Fig. 10b . . Heavy load crack and interior flow.



SPINS LIKE "BLAZES"—

so Radiography checks each one



Radiograph of oil scavenger rotor in variable displacement pump for aircraft hydraulic systems.

"BLAZES" is not the word—but suggests the maker's shorter expression for the rate at which this rotor spins. Fact is, rpms are so high that the soundness of the casting is important in terms of safety as well as serviceability.

So radiography goes to work and plays its unique part. With no damage to the product, radiography looks inside the part and checks each rotor's structure. Only flawless parts will meet the strict requirements of service.

Proving soundness with x-rays has become common practice with more and more suppliers of quality castings. They know it helps build reputations for delivering only good work.

If you'd like details on how radiography can improve your operations, get in touch with your x-ray dealer—or write us for a free copy of "Radiography as a Foundry Tool."

EASTMAN KODAK COMPANY
X-ray Division
Rochester 4, N. Y.

Radiography...

another important example of Photography at Work

Kodak

CIRCLE NO. 82, PAGE 81-82

International Congress

Continued from page 61

used mainly, some squeezing the cope and drag simultaneously.

"The cupola was the British balanced blast type with "siphon" type taphole. Metal stream was stopped by simply cutting off the blast by closing a slide gate against a fan type blower. Melting rate was reduced one-third by this method. Here again casting finish was excellent.

"On June 29, we visited the pipe foundry of Stanton Iron Works. In the pipe fittings part of the foundry many fairly good sized fittings molds are handled on a mechanized mold conveyor. Slingers and cope-squeeze machines are most commonly used. There was a shell molding station for shell cores for fittings of about 18-in. diameter. Mechanization was extensively used throughout the fittings and the De-Lauvaud pipe spinning foundries.

"On June 30 we visited the Metropolitan-Vickers Electrical Co., Trafford Park Works, at Manchester. This foundry produces castings for a wide range of products for power generation and transmission as well as electric traction and industrial electrification. Castings vary in weight from a few ounces to many tons and include small instrument castings. Something like 27 different metal compositions are used, both irons and non-ferrous metals. Molds are made by the loam, dry sand, skin dried, green and shell processes.

"Mechanization is carried out to a high degree wherever production conditions permit. Hydraulic blast cleaning for large castings is employed here.

"On July 1 we visited the National Gas & Oil Engine Co. near Manchester. Castings made range from a few ounces to 15 tons and again we saw loam, dry and green sand molding. They make both plain and alloy irons. They operate cupolas and a rotary furnace which is largely used for refined pig iron for the cupolas.

"After lunch we visited Mather & Platt, Ltd., producers of castings for centrifugal pumps, electric generators, textile machinery, forging presses and other heavy machinery.

ART IN IRON

Old German Ironmasters in the early 1800's created delicate art treasures such as those pictured above. This art flourished during the Thirty Years' War when other metals were unobtainable and now these trays with their delicate tracery of detail have become museum pieces of real value. Today we move at a faster pace in foundry procedures. Speed, precision, and utility are continually demanded and we have drifted away from the old idea of art for art's sake.

At United we are not artists. All our own skills are centered in making better bonding agents for cores and now for the pay-off, we offer Aqua-set as the fastest, cleanest and most versatile of any time-tested binder in the field. Aqua-set is a resin type binder and when we say it's fast to bake out, we mean really fast. Minutes after cores are dried of moisture with oven heat, they are cured and ready for use. If gas has been a problem then you will want to know that the total gas content of Aqua-set is less than half that developed in a conventional binder.

Would your cleaning room appreciate easier going, then they should know that spent cores, with a tap or two on the casting, pour out like sand. What else is needed in a core binder to recommend its use? Nothing but a moderate cost and here we can ring the bell again. The price tag on Aqua-set makes it a bargain in any language, and for the foundry's special convenience, it is offered in two forms—both as a liquid and a dry binder.

The whole story on Aqua-set makes interesting reading. It contains tests run by authorities in the foundry field and shows in pounds per square inch just what strength you can expect to get in various sand mixes. You will want this folder and it is yours for the asking.

AQUA-SET

A SYNTHETIC CORE BINDER

LIQUID OR DRY

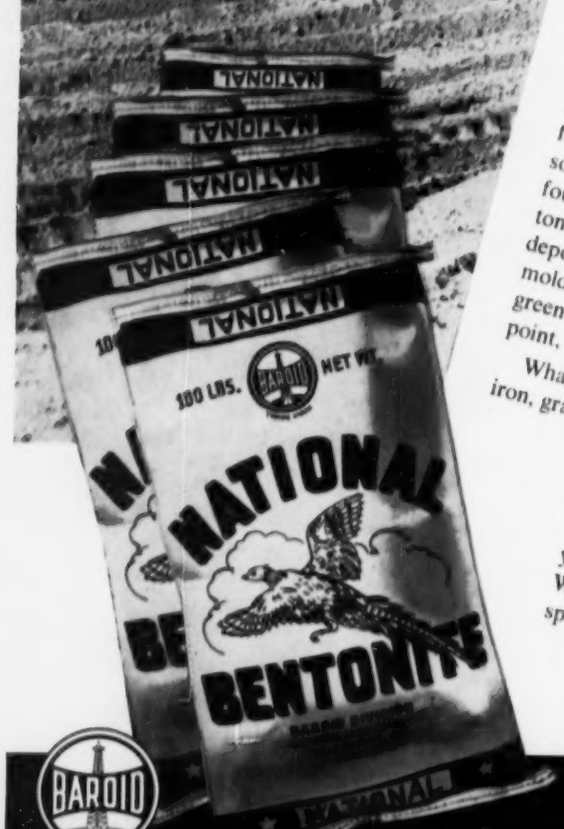
The fruit bowl and sandwich tray shown above are part of the Lamprecht Collection of Cast Iron Art and are shown through the courtesy of their owner, The American Cast Iron Pipe Company. If you are interested in knowing more about this remarkable collection, please write us for a booklet which describes it in detail and which we will gladly mail to you on request.

UNITED OIL MFG. COMPANY

1429 WALNUT STREET, ERIE, PA.

CIRCLE NO. 127, PAGE 81-82

NATIONAL BENTONITE helped manufacture this Caterpillar® giant!



This Caterpillar® DW21 Tractor and Scraper — shown stripping blow sand overburden from a deposit of bentonite — had many of their important parts cast in molds bonded with this same mineral. Castings for such heavy equipment must obviously be cast sound without any defects. That's why scores of good foundrymen the nation over specify National Bentonite to bond their molds. It's mined from the purest deposits of bentonite in the world . . . provides greater mold permeability, higher tensile strength, good green strength, higher hot strength, higher sintering point, and many other advantages.

Whatever the metal you're pouring — malleable iron, gray iron, steel, brass, aluminum, or magnesium — National Bentonite used as a bonding agent in your sand will produce finer, smoother castings and cut your reject loss. There are scores of good reasons why you should specify National Bentonite. Write today for folder and technical specifications.

5025

BAROID

Baroid Division ☆ National Lead Company

Bentonite Sales Office: Railway Exchange Building, Chicago 4, Illinois

Baroid

CIRCLE NO. 79, PAGE 81-82

foundry facts

Castings Properties

■ The almost complete range of mechanical and physical properties of castings make them desirable (in fact, preferred) for many structural and nonstructural applications.

Because many of their good properties are not understood by engineers, practical, efficient, and economical applications for castings may be overlooked.

First thought on hard or tough alloys, of course, is to cast them.

When one realizes that the casting process has only slight limitations on size, shape, and intricacy . . . that metal is put where it is wanted, greatly reducing machining . . . that casting properties compare favorably with wrought metal properties—these tables increase appreciation of the casting process.

Mechanical properties usually involve the relationship of stress and strain in forms such as modulus of elasticity, tensile strength, and fatigue limit.

Examples of physical properties are density, electrical conductivity, and coefficient of thermal expansion.

Casting properties are controlled by the following methods:

1. Properties of the casting are largely determined by properties of the base metal.

2. Adjustment of base-metal properties can be made with judicious selection of alloying elements.

3. Microstructure may be controlled by ladle additions and controlled cooling rates.

4. Heat treatment is a final method for adjusting and controlling properties of castings.

The table below, "Mechanical Properties of the Principal Types of Casting Alloys," and the table on the next page, "Relative Properties of Cast Ferrous and Non-Ferrous Alloys," are adapted from Chapter 2, General Properties of Cast Metals, of the forthcoming revised CAST METALS HANDBOOK, published by the American Foundrymen's Society.

Mechanical Properties of the Principal Types of Casting Alloys

Cast Metals	Tensile psi x 1000	Yield psi x 1000	Compression psi x 1000	Shear psi x 1000	Elong % per 2-in.	Area Reduct %	Hardness Brinnell (3000 kg)	Hardness Rockwell C max	Modulus of Easticity psi x 10^6	Endurance Limit psi x 1000	Impact Resistance ft lb
Gray Cast Iron	20- 80	20- 80[c]	3-5xTS	1-1.6xTS	3-0	0	135-350+[g]	60-64	12 -22	0.4-0.6xTS	Low[l]
Malleable Iron[a]	48-120	30- 95	48-120[e]	0.9xTS	26-1	23-0	125-285+	60-64	25	0.4-0.6xTS	1-20
Nodular Iron	60-200	40-135	40-135[e]	0.9xTS	26-1	30-0	140-330+	60-64	24 -26	0.4-0.55TS	1-20
Steels[b]	60-200	30-170	60-200	——	35-5	65-5	130-750[h]	65-66	30	0.4-0.5 TS	3-65
		0.2% Offset					500 kg Load	E Scale			
Aluminum-base	19- 53	8- 43	8- 43[c]	14-36	22-0	——	40-140	——	10.3	6.5 -23	½-35[m] 0- 8[n]
Copper-base	21-125	11-100[d]	——	——	52-0	40-4	47-425	——	9.1-20	4 -15	½-40[o]
Magnesium-base	23- 45	14- 30	14- 30	14-21	12-1	——	50- 85	60-90	6.5	9 -13[k]	½-10[p]
Ni & Ni-Cu	50-145	25-115	18- 60[f]	——	45-1	35-1	100-375[i]	——	21.5-24	———	4-70[p] 3-80[o]
Other Ni-base	68-118	40-118	——	——	30-0	47-0	155-390[i]	——	22.5-28	———	3-60[q] 25-85[q]
Zinc-base	25- 52	——	55- 93	31-46	10-½	——	75-100[j]	——	——	6.875-8.5	1-48[m]

a . . Ferritic and pearlitic malleable irons
b . . Carbon and low alloy steels
c . . about the same as tensile strength
d . . 0.5% extension under load
e . . about the same as yield strength
f . . few data available; compressive yield strength given
g . . TS/Bhn = 0.16 to 0.21; TS = 1.82 (Bhn) 1.85 also used
h . . surface hardnesses up to 900 Vickers; TS/Bhn = 0.47 to 0.48
i . . Nickel alloys tested with 3000-kg load
j . . load held 30 sec
k . . based on 500,000,000 cycles on R.R. Moore-type machine and specimen
l . . Charpy V; 20 to 80 ft lb on 1.125 in. diam round bars, unnotched, machined from halves of 1.20 in. diam traverse bars and broken on 6-in supports.
m . . Charpy unnotched, ¼-in. square cast bar
n . . Charpy V-notched, ¼-in. square cast bar
o . . Izod bar
p . . Charpy keyhole notched bar
q . . data not available for all alloys; some have low impact resistance.

700° wasn't too Hot for this BELT . . .

IT LASTED TWICE AS LONG . . .

Dangerous and expensive shutdowns were avoided when a Dandux Double Insulex stitched canvas belt was installed in the refractory above. The heavy asbestos cover, with two insulation layers between it and the body of the belt carried material at 700°, more than twice as long as the rubber belt previously used.

Insulex belting may save you money too.

Write: C. R. DANIELS, Inc. Daniels, Md. for free 32 page Belting Manual

Offices in principal cities:
New York Chicago
Philadelphia Detroit
Pittsburgh Milwaukee
Minneapolis Cleveland
Dayton

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Relative Properties of Cast Ferrous and Non-Ferrous Alloys

Property	Gray Cast Iron	Malleable Iron	Nodular Iron	Carbon & Low-Alloy Steel	Aluminum-base Alloys	Copper-base Alloys	Magnesium-base Alloys	Nickel-base Alloys	Zinc-base Alloys
Machinability[a]	good (3.5)	good	good	less than other ferrous alloys (6.5)	good to excellent (1.8)	fair to good (2.3 - leaded yellow brass)	excellent (1.0)	comparable to steel	excellent
Damping Capacity	approximately ten times that of steel	— — — — — — — — — — — — — — roughly related inversely to the modulus of elasticy — — — — — — — — — — — — — —							
Wear Resistance, lubricated sliding friction	excellent	Pearlitic - excellent Ferritic-good	good to excellent	good - improved by heat treatment	poor to excellent	good to excellent	poor to excellent	comparable to steel	poor
Suitability as a bearing material[b]	poor to excellent	Pearlitic - excellent Ferritic - poor	poor to excellent	inferior to cast iron	poor, except for special bearing alloy	good to excellent	poor	not used as a bearing normally	poor
Abrasive Wear[c]	excellent for special alloys	Pearlitic[c]	Pearlitic[c]	excellent for special alloys	poor	poor to good	poor	poor to good	poor
	— — — — — — depends on hardness — — — — — —					— — — — — — depends on hardness — — — — — —			
Notch Sensitivity[d]	Ferrous alloys are fairly comparable on basis of unnotched to notched bar in fatigue test; cast steel is less sensitive than wrought steel.				yes				
						— — — — — — few data available — — — — — —			
Section Sensitivity[e]	yes	no	As-cast - yes Annealed - no	to a limited extent	yes	— — — — — — to a limited extent — —		die castings are not	
Suitability for joining by:									
Brazing	yes	yes	yes	yes	yes (few)	yes	no[f]	yes	no[f]
Soldering	yes	yes	yes	yes	yes	yes	yes	yes	yes
Welding	yes with special precaution — — — — — — —			with ease[g]	yes[h]	yes	yes	yes	yes
Fluidity	excellent	good	excellent	inferior to cast iron	excellent	fair to good	good to excellent	comparable to steel	excellent
Susceptibility to Hot Tearing	no	yes	no	yes	— — — — depends on composition — — — —			like steel	no
Pressure Tightness	yes	yes	yes	yes	— — — — " " " — — — —			yes	yes
Properties improved by heat treatment	yes	yes - 100% heat treated	yes	yes	yes - for most alloys	yes - for a few alloys	yes - for most alloys	yes - for a few alloys	no, except dimensional stability
Subject to property control through inoculation, ladle treatment, etc.	yes	mildly so	treatment is necessary	mildly so	yes - for a few alloys	mildly so	yes	no	no

a . . Figures relate power requirements to that for machining magnesium-base alloys.
b . . Excellence as a bearing alloy, among other things, requires proper metal structure; for instance, ferrite in ferrous castings is generally avoided. In cast irons, proper size and distribution of graphite flakes is also important.
c . . Good abrasion resistance in ferrous alloys can also be obtained by surface hardening treatments.
d . . Limited data does not justify a more critical comparison.
e . . Variation in properties of a casting depending on section size or cooling rate.
f . . Low melting points of these alloys precludes use of this method.
g . . Up to 0.35 per cent C.
h . . Preparation of surface and selection of welding rod and flux are important.

BIG SAVINGS IN PATTERN SHOP TIME AND LABOR with SCIENTIFIC Pressure Cast MATCH PLATES

YOU NEED NO MORE THAN ONE MASTER PATTERN

• FROM IT WE MAKE PRECISION MULTIPLE DUPLICATES IN ONE COMPACT MOLD.

Cast of aluminum, the plates are poured under pressure to assure filling all detail. Molding is done in plaster only, for extreme accuracy.

Expensive duplicate master patterns and high cleaning costs are eliminated.

WRITE FOR BULLETIN NO. 52

The SCIENTIFIC CAST PRODUCTS Corp.

1390 East 40th Street
CLEVELAND 3, OHIO

2530 West Lake Street
CHICAGO 12, ILLINOIS

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let's get personal

continued from page 25

Industries, Cleveland. He will be in charge of sales in 11 western states, with headquarters in San Francisco.

S. C. Massari

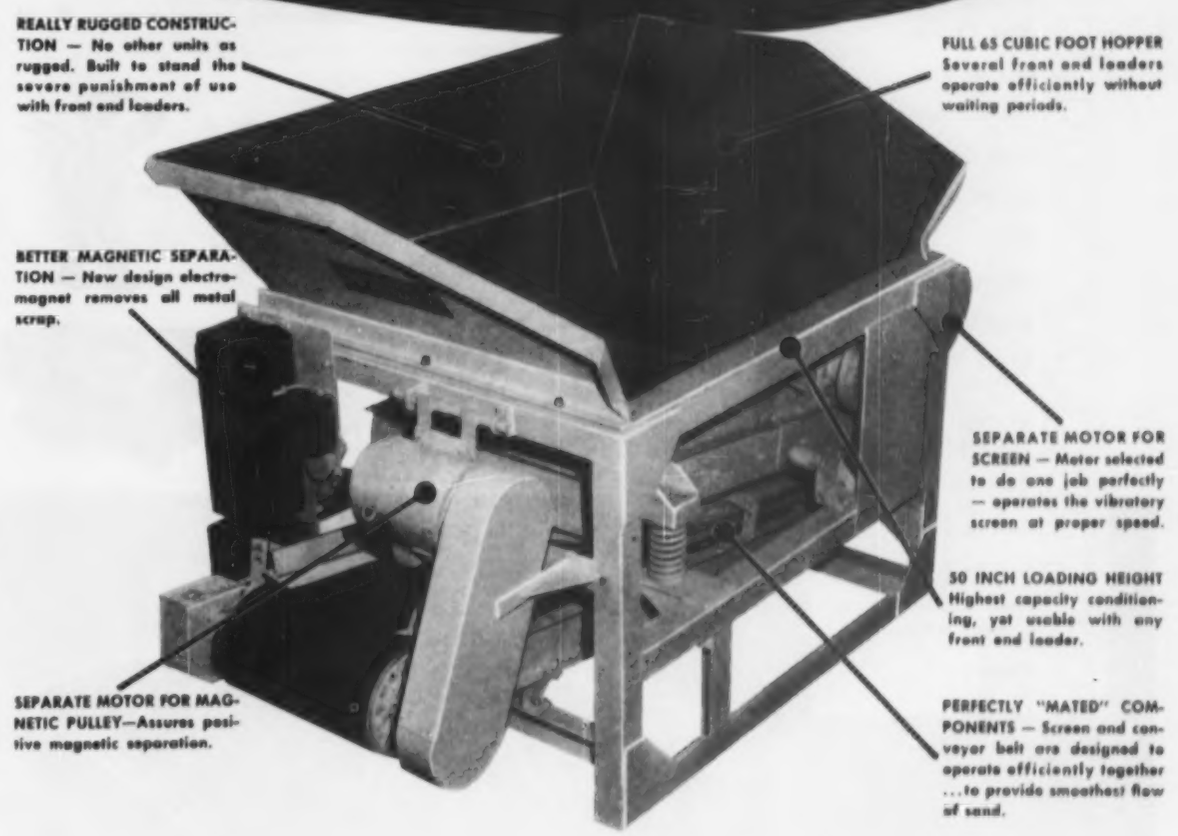
S. C. Massari, former technical director of the American Foundrymen's Society, has been selected to present the Charles Edgar Hoyt Memorial Lecture at the 1956 AFS Convention in Atlantic City, N. J., May 3-9. Also nominated at a recent meeting of the AFS Annual Lecture Committee was **Hyman Bornstein,** who will deliver the Hoyt Lecture at the 1957 convention of the society.

C. H. Kimmel was elected president of Ohio Crankshaft Co., Cleveland, at the annual board of directors meeting. **M. J. Hoke** was

Hyman Bornstein

the new "80" Preparator

• RUGGED NEW UNIT FULLY CONDITIONS 78 TONS PER HOUR...REQUIRES NO PITS

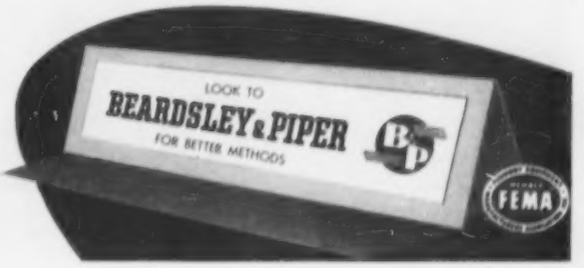

REALLY RUGGED CONSTRUCTION — No other units as rugged. Built to stand the severe punishment of use with front end loaders.
FULL 65 CUBIC FOOT HOPPER Several front end loaders operate efficiently without waiting periods.
BETTER MAGNETIC SEPARATION — New design electromagnet removes all metal scrap.
SEPARATE MOTOR FOR SCREEN — Motor selected to do one job perfectly — operates the vibratory screen at proper speed.
50 INCH LOADING HEIGHT Highest capacity conditioning, yet usable with any front end loader.
SEPARATE MOTOR FOR MAGNETIC PULLEY—Assures positive magnetic separation.
PERFECTLY "MATED" COMPONENTS — Screen and conveyor belt are designed to operate efficiently together ...to provide smoothest flow of sand.

Now, highest capacity and above floor construction have been combined in the new B & P "80" Preparator. Up to 78 tons of sand may be thoroughly conditioned each hour, yet overall dimensions and space requirements are lower than for machines of far less capacity.

The new "80" is available for both independent use and for use with Speedmuller-Preparator units. A loading height of only 50 inches makes it usable with any front end loader. The large hopper capacity of 65 cubic feet facilitates fast loading with no waits while the hopper empties.

No other conditioning unit available will thoroughly screen and magnetically separate as high a capacity of sand as the new "80" Preparator.

Write now for details: Beardsley & Piper, Division Pettibone Mulliken Corporation, 2424 North Cicero Avenue, Chicago 39, Illinois.



CIRCLE NO. 80, PAGE 81-82

Check List for your FOUNDRY NEEDS!

The STERLING Line:

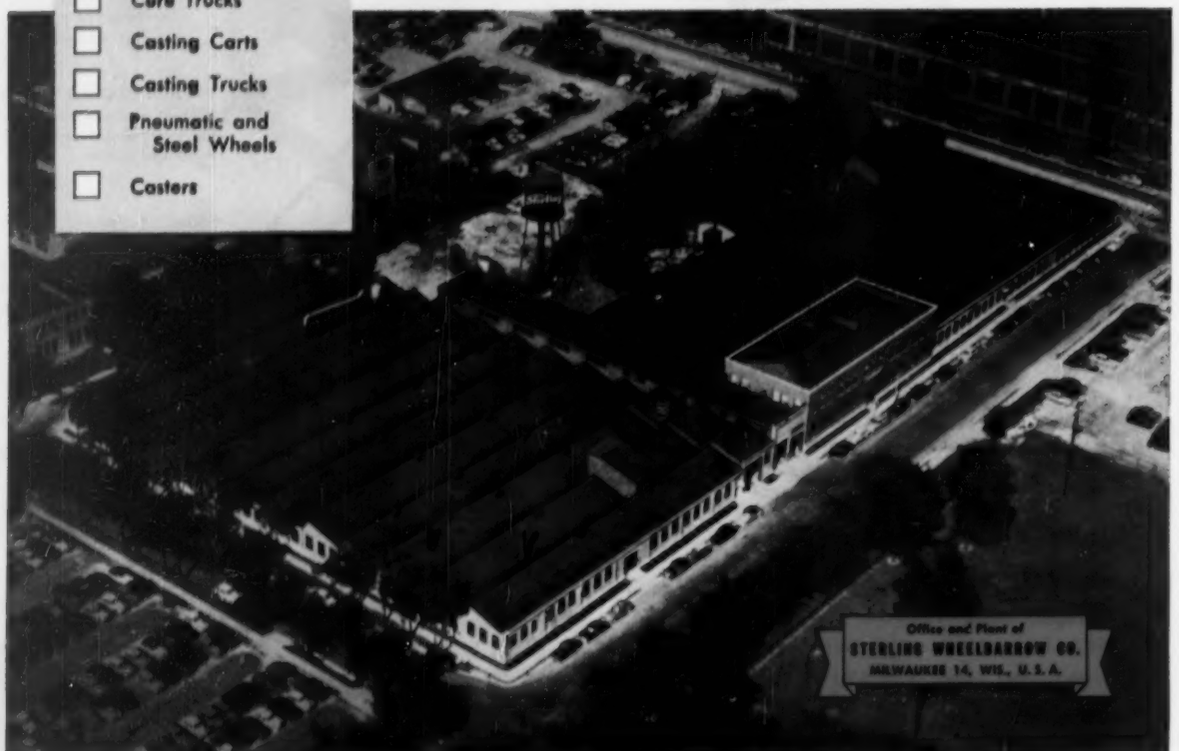
- ☐ Standard Flasks
- ☐ Heavy Duty Flasks
- ☐ Stack Molding Flasks
- ☐ Steel Flask Bars
- ☐ Flask Clamps
- ☐ Clamping Bars
- ☐ Pins and Bushings
- ☐ Steel Core Plates
- ☐ Bottom Boards
- ☐ Bands
- ☐ Upsets
- ☐ Slag Buggies
- ☐ Heavy Duty Wheelbarrows
- ☐ General Wheelbarrows
- ☐ Core Trucks
- ☐ Casting Carts
- ☐ Casting Trucks
- ☐ Pneumatic and Steel Wheels
- ☐ Casters

Progressive foundrymen, all over the world, look to Sterling for their flasks and other foundry needs. They KNOW, if the equipment comes from Sterling, it's soundly engineered and built to highest quality standards. So play safe. Always specify Sterling. Check the list for your current requirements. We'll gladly send you literature and prices.

It Pays to Specify

Sterling

because
Sterling is TOPS in
the Foundry Equipment Field.



Branches: BOSTON • BUFFALO • CHICAGO • CLEVELAND • DETROIT • PALO ALTO • NEW YORK • PHILADELPHIA • ST. LOUIS
Subsidiary Company: STERLING FOUNDRY SPECIALTIES, LTD., London, Bedford and Jarrow-on-Tyne, England

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named vice-president and general manager of the crankshaft and camshaft division. **W. C. Dunn**, co-founder and president of the firm since its inception, continues as board chairman.

John P. McGury

John P. McGury has been added to the staff of the National Foundry Association. He resigned from the firm of Kelliher, Bowen and McGury, known in the field of labor arbitration, to join the staff of NFA.

Glenn F. Ihrig

Glenn F. Ihrig has been promoted from assistant sales manager to general sales manager of the Wellman Bronze & Aluminum Co., Cleveland.

E. W. Popham has been appointed purchasing manager of the Metals Processing Div., Curtiss Wright Corp., Buffalo, N. Y.

H. Maurice Banta has been named technical adviser at Battelle Institute, Columbus, Ohio. In his new position he will advise the Institute's clients in the iron and steel and

metal fabricating industries on the formation of their research programs.

Slade B. Gamble and **Henry L. Eickelberg** have joined the sales organization of Lindberg Industrial Corp., Chicago, as application engineers for field-erected furnace installations.

Edward H. Schubert has joined the Foundry Equipment Div., Westover Engineers, Milwaukee, as mechanical engineer.

E. C. Conary

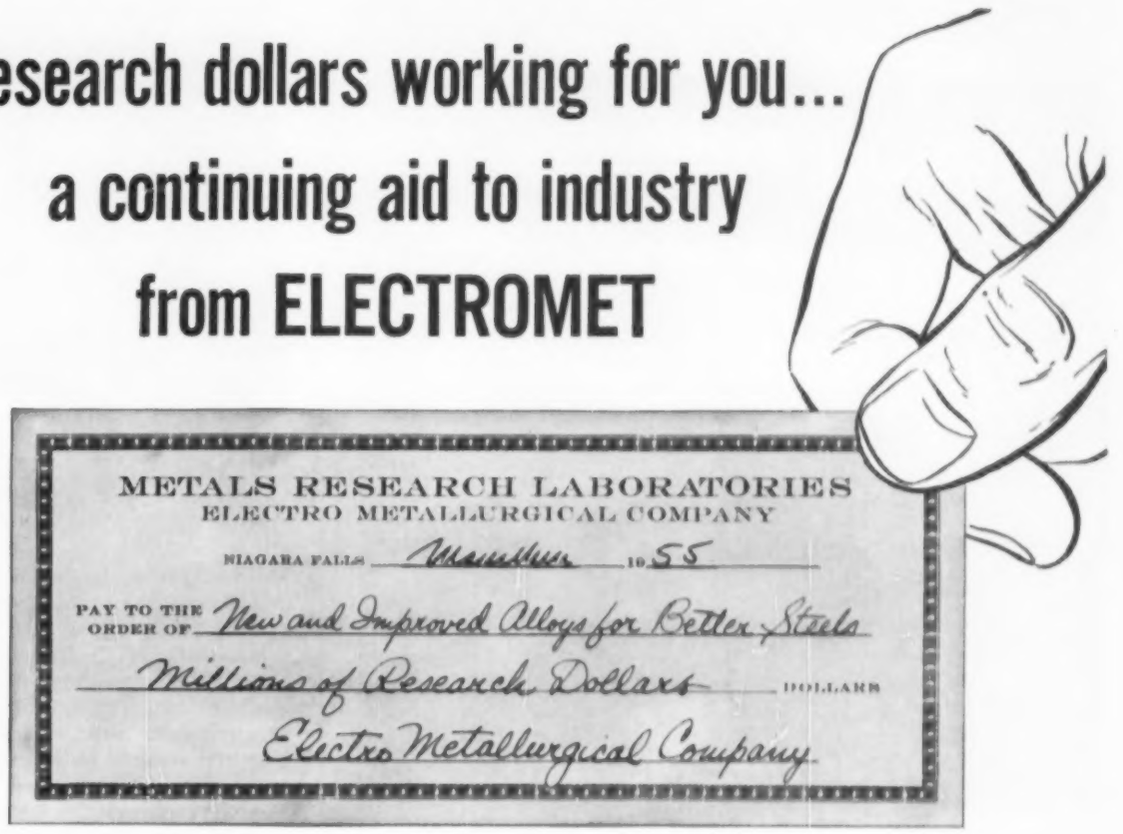
E. C. Conary, formerly of Worcester, Mass., has been appointed general manager of the Genesee Foundry Co., Syracuse, N. Y.

John H. Romann has been made chairman of the board of Prescott Co., Menominee, Mich. His new address will be 1412 Government Street, Mobile, Ala.

Roderick L. Smith has been appointed an abrasive engineer in the Minneapolis area by Norton Co. He will

Edward H. Schubert

Research dollars working for you... a continuing aid to industry from ELECTROMET


METALS RESEARCH LABORATORIES
ELECTRO METALLURGICAL COMPANY
NIAGARA FALLS Marathon 10 55
PAY TO THE ORDER OF New and Improved Alloys for Better Steels
Millions of Research Dollars DOLLARS
Electro Metallurgical Company

ELECTROMET's *research laboratories spend millions of dollars to develop new and improved alloys for better steels—and you receive the benefits.*

More than 300 skilled research scientists, engineers, and technicians work in ELECTROMET's Metals Research Laboratories on the solution of metallurgical problems. They develop new and improved ferro-alloys and metals, better ways of using them, and new and improved alloy steels and irons.

ELECTROMET conducts this continuing research program as a bonus for you, to provide high-quality ferro-alloys and valuable technical service.

You can profit from this continuing research program. For help on your problems in the use of ferro-alloys or the metallurgy of alloy steels or irons, please contact the nearest ELECTROMET office listed below.

The term "Electromet" is a registered trade-mark of Union Carbide and Carbon Corporation.

ELECTRO METALLURGICAL COMPANY
A Division of Union Carbide and Carbon Corporation
30 East 42nd Street UCC New York 17, N. Y.
OFFICES: Birmingham • Chicago • Cleveland • Detroit
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TRADE MARK
Ferro-Alloys and Metals

CIRCLE NO. 83, PAGE 81-82

CARBON CONTROL

With the proper size of Semet-Solvay Foundry Coke in your cupola, variations in carbon and other important characteristics are held to a minimum. This means better castings, lower scrap losses and more economical melting.

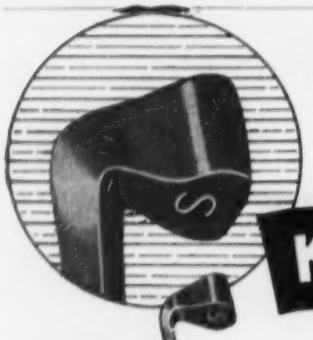
SEMET-SOLVAY DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street — New York 6, N. Y.
Buffalo • Cincinnati — Cleveland • Detroit
In Canada: SEMET-SOLVAY COMPANY, LTD., Toronto
Western Distributors: WILSON & GEO. MEYER & CO., San Francisco

For Better Melting

CIRCLE NO. 123, PAGE 81-82

STANDARD
does it again!

The KOOLHEAD 90°



The 90° bend under the head simplifies your operation and places the chill where it belongs. The "Koolhead 90°" will perform two duties: (1) a chill and (2) holding the sand on the surface of the mold. We feature clean, bright finished Horse Nails and can furnish the new bent head in any of the various "Koolhead" types.

Write for samples and prices.

CHILL KOOLHEAD NAILS

STANDARD HORSE NAIL CORP

CIRCLE NO. 124, PAGE 81-82

Russell F. LaBeau

Floyd Gladwin

succeed **W. Grover Snow,** who has retired after nearly 40 years' service with the comany.

Floyd Gladwin, E. Edwin Ensign and **Russell F. LaBeau** have organized a new foundry equipment firm called the Gee Co., Ypsilanti, Mich. Shell molding machines, shell core blowers and allied foundry equipment will be produced. The new concern utilizes the combined resources of Gladwin Corp., Metco Processing Corp., and the R. F. LaBeau Co., to produce its new line of products.

G. L. McMillin has been named vice-president-steel foundry, Canadian Car & Foundry Co., Ltd., Montreal, Canada.

W. H. Osborne, formerly vice-president, secretary and treasurer of Acme Aluminum Foundry Co., Chicago, and been elected executive vice-president. He retains the positions of secretary and treasurer. **C. L. Sidinger** was also elected vice-president in charge of manufacturing and engineering.

H. Dorsey Hammond

Harold M. Gowing

G. L. McMillin

E. Edwin Ensign

Dallas C. Amburn

Electric Steel Foundry Co., Portland, Ore., has appointed **Harold M. Gowing** manager of the Public Relations Dept., a newly created department of the company.

H. Dorsey Hammond has been appointed sales manager of Arlington Bronze & Aluminum Corp. and Danko Pattern & Mfg. Co., Inc., Baltimore, Md.

Dallas C. Amburn has been appointed assistant industrial sales manager of Swan-Finch Oil Corp., with headquarters at their Detroit district office.

Walter J. Bemb has been elected vice-president in charge of customer relations of Aluminum Industries, Inc., Cincinnati.

James J. Reynolds has been named vice-president-operations of Alco Products, Inc. He was formerly vice president of industrial relations. **G. Y. Taylor** has been named manager of employee services.

Walter J. Bemb

. . . AND GET *More* PERFECT CASTINGS

DELTA Z-KOAT and ZZ-KOAT Washes are easy to mix and easier to apply. After mixing, there is no danger of precipitation and, when dried, they are completely moisture-proof. Applied by swabbing, dipping or brushing, they adhere uniformly to the sand and produce smooth, highly-refractory surfaces.

Both DELTA Z-KOAT and ZZ-KOAT Washes have unusually high fusion points and, because of their high heat conductivity, provide a more rapid surface-metal set. Both washes are economical to use.

DELTA Z-KOAT contains zirconium plus other high fusion refractories and DELTA ZZ-KOAT is an all-zirconium type wash.

DELTA

Working samples and complete literature on Delta Foundry Products will be sent to you on request for test purposes in your own foundry.

DELTA

DELTA OIL PRODUCTS CO.

MANUFACTURERS OF SCIENTIFICALLY CONTROLLED FOUNDRY PRODUCTS

MILWAUKEE 9, WISCONSIN

CIRCLE NO. 81, PAGE 81-82

Controlling flow of coal to proper screens

SYNTRON

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CIRCLE NO. 125, PAGE 81-82

A. Rasmussen

A. Rasmussen has been appointed sales manager of the LaPorte Foundry Co., LaPorte, Ind.

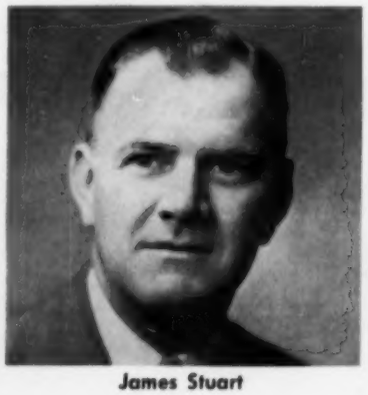
Arthur Townhill has joined the Harwill Corp., Los Angeles, as director of engineering.

E. W. Adams has been appointed plant manager of Kaiser Aluminum & Chemical Corp's. new basic refractory brick plant, soon to be constructed at Columbiana, Ohio.

L. P. Metesser, West Coast representative for Cleveland Vibrator Co., Cleveland, has added Idaho, Utah and Arizona to his territory.

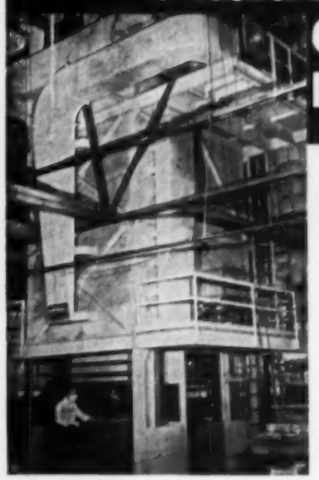
Mrs. Helen E. Schneible has been appointed president of Claude B. Schneible Co., Detroit, succeeding her late husband, Claude B. Schneible, who founded the firm.

James Stuart has been appointed sales manager of Tabor Mfg. Co., foundry molding machine manufacturing division of Turbo Machine Co., Lansdale, Pa. He was formerly assistant sales manager of Osborn Mfg. Co., Cleveland.



James Stuart

CARL-MAYER *Industrial* OVENS, FURNACES



Carl-Mayer Vertical Core Oven (with a newly patented recirculating heating system) at G & C. Foundry Co., Sandusky, Ohio. U. S. Patent Nos. 2,257,180 and 2,628,087.

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THE CARL-MAYER CORPORATION
3030 Euclid Ave., Cleveland 15, Ohio

CIRCLE NO. 108, PAGE 81-82

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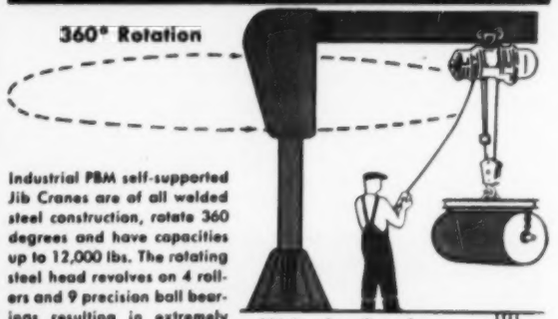

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Industrial PBM self-supported Jib Cranes are of all welded steel construction, rotate 360 degrees and have capacities up to 12,000 lbs. The rotating steel head revolves on 4 rollers and 9 precision ball bearings resulting in extremely smooth operation — unsurpassed by any other crane of its type. The high standard of workmanship and material, coupled with reliable performance make Industrial Jib Cranes your best buy.

Industrial manufactures 6 other types of Jibs and many models of Overhead Traveling Cranes to cover every need. Consult with Industrial for cranes to solve your material handling problems.

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CIRCLE NO. 115, PAGE 81-82

Establish Lillieqvist Award

■ Gustaf A. Lillieqvist, who passed away May 31 and whose entire life was devoted to technical and scientific leadership in the steel castings industry, has been recognized and honored by the directors of the Steel Founders' Society through the establishment of the Gustaf A. Lillieqvist Steel Foundry Facts Award.

At the time of his death, Dr. Lillieqvist was research director of American Steel Foundries and was closely associated with SFSA activities as a member of its Technical and Research Committee. He was

G. A. Lillieqvist

previously a member of the Specifications Committee from 1942-1953 and its chairman in 1953. In 1951 and 1952 he was chairman of the Division VI Technical and Operating section, and in 1952 he received the Technical and Operating Gold Medal from the Society for his outstanding contributions to the technology of steel castings.

Mr. Lillieqvist presented the Official Exchange Paper from the American Foundrymen's Society to the Institute of British Foundrymen at the 1952 IBF Convention. At the time of his death he was a member of the AFS Steel Division's Executive and Research Committees and the Annual Lecture Committee.

Steel Foundry Facts is a monthly publication of steel casting technology circulated to SFSA members. The Gustaf A. Lillieqvist Steel Foundry Facts Award will be made annually by the board of directors for the best paper published in the preceding year. In his own lifetime Dr. Lillieqvist was a frequent contributor to this publication.

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CIRCLE NO. 95, PAGE 81-82

R. E. Kennedy, AFS Secretary Emeritus, Dies

■ Robert E. Kennedy, secretary emeritus of the American Foundrymen's Society and secretary of the AFS Alumni Group, died of a heart attack August 7 three days after celebrating his 68th birthday.

Affectionately known as "Bob" to thousands of foundrymen, he was considered the "father of the AFS chapter movement." He attended every AFS Convention from his first at Detroit in 1910 when he was a foundry student. Since his retirement as AFS secretary in 1945 he has been a familiar figure to convention-goers as he supervised Old Timers registration and distribution of 25- and 50-year veteran pins.

At the Convention in Houston last May he was named secretary of the AFS Alumni Group—past and present national officers and directors, medalists, and honorary life members—replacing the late C. E. Hoyt, retired executive vice-president of the Society, who died in January. Thus, in the tenth year of their retirement, AFS has lost the two men who built up the Society—Ed Hoyt, the administrator and exhibits manager, and Bob Kennedy, builder of chapters and technical programs.

Secretary of the Society from 1938 until his retirement in 1945, Bob joined the staff of AFS (then American Foundrymen's Association) as assistant secretary in 1921, being named technical secretary in 1925. He carried on AFS duties from 1921 to 1928 while teaching at the University of Illinois.

He has been identified with some of the outstanding advances in the castings industry, particularly in the field of sand testing and control, pattern standardization, and refractories. Modern sand control got its start through research conducted by Harry W. Dietert as a graduate student under Bob Kennedy at the University of Illinois.

Robert E. Kennedy 1887-1955

Bob presented papers at the following AFS Conventions: 1914, *"Elimination of Waste Motion in Bench Molding;"* 1915, *"Organization in the Foundry of the University of Illinois Shop Laboratories;"* 1916, *"Analyzing Foundry Operations as a Basis for Improvement in Shop Conditions;"* 1920, *"Training Foundry Executives."*

He taught foundry practice at both University of Illinois campuses, joining the Chicago Undergraduate Branch (Navy Pier) in 1946 to develop foundry and pattern courses and laboratory facilities after leaving AFS. He retired as assistant professor in 1953.

In recognition of his long service to the castings industry, AFS awarded Bob its Joseph S. Seaman Gold Medal in 1945 "for outstanding meritorious service to all branches of the foundry industry through his work in organizing and guiding the development of technical and operating papers and discussions, and his untiring encouragement to all AFS chapters, committees and members." Kindliness, the characteristic of the donor chosen as the theme for the Seaman medal, truly characterized Bob.

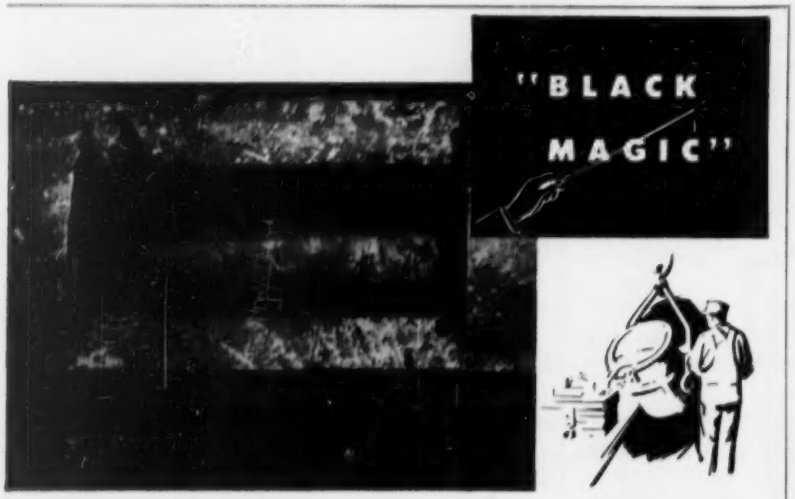
The Chicago Chapter of AFS established the Robert E. Kennedy Scholarship at the Navy Pier Branch of the University of Illinois in 1954. His family requested that contributions be made to this scholarship fund in lieu of sending flowers for the funeral service. In 1953 the Foundry Educational Foundation cited him for his then 44 years of service to the castings industry on the occasion of his retirement from the University of Illinois teaching staff and at the same time established a scholarship in his name.

Born in Vincennes, Ind., August 4, 1887, Bob received his preliminary education there. He graduated from Winona Technical Institute, Winona, Ind., in 1909, where he specialized in foundry practice, and later from the University of Illinois (Urbana) in industrial education.

From 1910 to 1917 he was instructor in foundry practice at the university, and from 1919 to 1921 headed foundry as assistant professor.

During World War I, Bob was assigned to the steel foundry at Watertown Arsenal, Watertown, Mass., for a time. Following his discharge from the Army in 1919 he was appointed assistant superintendent, U.S. Training Service, foundry training, Department of Labor, where he prepared bulletin No. 24 entitled "Industrial Training for Foundry Workers." He then returned to the downstate campus as foundry superintendent.

He is survived by his widow, Nellie Reed Kennedy, and daughter, Alice, both of Westville, Ind., where their address is Box 539.



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CIRCLE No. 126, PAGE 81-82

new books

Stress Concentration Design Factors . . R. E. Peterson. ix+155 pp. John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. 1953. $8.50.

Charts and relations useful in making strength calculations for machine parts and structural elements provide information to enable the designer to improve his calculations and thus reduce failures due to poor design; to be considered as a working tool rather than a textbook.

Proceedings of the Eighth Annual Management Engineering Conference — The Control of Indirect Costs. 134 pp. Agricultural and Mechanical College of Texas, College Station, Tex., 1955. $1.50.

Speeches from the conference at which communication problems between accountants and management, taxes affecting plants and equipment, cost control for an engineering department, a maintenance program, a cost reduction program for construction, automation, simplification of office procedures, learning curves as applied to production costs, quality control, and salesmanship were discussed.

Investment Precision Casting . . Roy W. Tindula. 25 pp. U. S. Dept. of Commerce, Office of Technical Services, Washington, D.C. PB 111001R 1954. $0.75.

Summarizes references to precision casting process in technical magazines and books as well as government reports and patents from 1933 to 1954, and describes the preparation of dies and patterns, molding methods, compositions used, investment, and heating and melting methods. Extensive bibliography.

ASTM Standards on Copper and Copper Alloys . . xiii+584 pp. American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa. 1954. $5.00.

Compilation of all standards developed by Committee B-5 on Copper and Copper Alloys castings, rods, bars, forgings, wire pipe and tubes, plate, sheet and strip, specifications on wires for electrical conductors and standards on lake and electrolytic copper, lead, nickel, etc.

How to Use Portable Power Tools . . Maurice H. Reid, viii+210 pp. 100 photos. Thomas Y. Crowell Co., 432 Fourth Ave., New York 16, N.Y. 1954. $2.95.

Selection, maintenance, and use of portable power tools. Many labor- and time-saving hints.

Appendix includes work and use characteristics of common woods, handy shop formulas, equivalents, weights and measures, abrasives information, etc.

In the castings industry, this book would be of particular interest to patternmakers and maintenance personnel.

Symposium on Effect of Cyclic Heating and Stressing on Metals at Elevated Temperatures . . (ASTM Special Technical Publication No. 165) 184 pp. American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. 1954. $3.00.

Covers situations involving periodic and relatively slow changes in stress or temperature or both. Intended to be of use both to the engineer-designer as an aid in designing for stress and temperature variations, and to the researcher as a spur to greater efforts to obtain more exact data or design criteria.

Handbook of Chemistry and Physics . . Charles D. Hodgman (ed.-in-chief) 36th ed. xxiv1 3+73 pp. Chemical Rubber Publishing Co., 2310 Superior Ave. N.E., Cleveland, Ohio. 1954. $8.50.

Divided into sections as follows: mathematical tables, general chemical tables, specific gravity and properties of matter, heat, hygrometric and barometric tables, electricity and magnetism, light, quantities and units, and miscellaneous, with index at beginning of each section.

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CIRCLE NO. 106, PAGE 81-82

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CIRCLE NO. 121, PAGE 81-82

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To order Malleabrasive, or for additional information on running a test, contact Pangborn Corporation, 1300 Pangborn Blvd., Hagerstown, Md.

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CIRCLE NO. 96, PAGE 81-82

GIFS Members Hold Joint Wisconsin-Chicago Meeting

Forty-eight foundry executives, members of the Gray Iron Founders' Society Wisconsin and Chicago Management Groups, attended the first regional meeting held in Waukegan, Ill.

Chairmen of the two groups, who spearheaded this organizational meeting, were H. Heatwole, J. E. Gilson Co., Port Washington, Wis., and J. Gajentan, Jr., Chicago Foundry Co., Chicago. Acting as co-chairmen they told of the development of the regional meeting program and described the operation of their own respective management groups.

GIFS president C. H. Ker congratulated the group for demonstrating their interest in getting together both in their local areas, as well as in the regional meeting. He enumerated the many benefits of association which leads to better understanding among foundry executives.

Execuive Vice-President D. H. Workman reported on current business conditions and stated that in 1955, gray iron shipments would approach 1953's near peak production, an increase of 10 to 15 per cent over 1954. Foundry business should continue strong in the last half of 1955, he said, and extend well into 1956 because of the optimism of gray iron's top ten consuming industries.

The group devoted over an hour to a discussion of wage rates and related problems, material costs and availability, sales promotion, and other matters currently of interest to foundry management.

Issue Apprentice Booklet

"Follow Up Study of Former Apprentices" points out that almost half of the former apprentices quit for higher-paying jobs; most of them needing more money to support growing families. This information is based on a sample survey conducted by the U. S. Department of Labor's Bureau of Apprenticeship of approximately 900 former apprentices who failed to complete their training.

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Mathews Completes Expansion Program

■ Mathews Conveyer Co., with main offices in Ellwood City, Pa., has combined the celebration of its 50th anniversary with the completion of the broadest expansion program in the company's history. The building program, which was started in January, 1954, and completed in June this year involves a new three-story engineering and office building and two major additions to the plant. Result is some 30 per cent increase in manufacturing area. Cost was approximately one million dollars.

The engineering and office building is a three-story brick, fire resistant structure, completely modern throughout. Lighting, air conditioning, and heating are all the most modern systems available. Building has 29,000 sq ft of floor space, the first floor housing the executive offices of the company. The second floor contains both proposal and detail engineering departments and the offices of all engineering supervisors. Lower floor level contains elaborate blueprinting equipment, a meeting room, research department, and is also used for storage of records and materials.

Additions to the manufacturing area involve a complete new truck shipping dock with hydraulically adjustable platforms, greatly enlarged sheet metal department and area for the assembly of standardized belt conveyers, and a complete new shipping area and the power conveyer assembly departments are equipped with new overhead cranes.

Odd H. McCleary, vice-president and general manager of the Ellwood Plant, stated that the new facilities were necessary for the company to meet the demand for the gravity and power conveyers and special conveying machinery in which the company specializes.

Open house for the public and employees and their families was held June 22. Customers, suppliers and invited guests attended an open house the morning of June 29, and a luncheon at the Connoquenessing Country Club.

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CIRCLE NO. 93, PAGE 81-82

Alloy Casters Elect

New president of the Alloy Casting Institute is Thomas Rutherford, Midvale Co., Philadelphia, it was announced June 28 at the Institute's 15th Annual Meeting. He succeeds C. K. Lockwood, vice-president of the Stainless Steel & Alloys Div., Shawinigan Chemicals Ltd., Montreal, Que.

Elected vice-president was Bradley B. Evans, Empire Steel Castings, Inc., Reading, Pa. Re-elected executive vice-president and treasurer was E. A. Schoefer, Mineola, N. Y.

Two new members named to the Institute's Board of Directors were: H. J. Cooper, Cooper Alloy Foundry Co., Hillside, N. J., and F. M. Fahrenwald, Fahralloy Co., Harvey Ill.

During the three-day meeting, reports of ACI's research work on cast heat-resistant and corrosion-resistant alloys were presented.

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Use Marshall Enclosed-Tip Thermocouples to measure the temperature of all three of your molten metals—brass, aluminum or magnesium—and thus make certain your melts are poured at just the right heat! Marshall Thermocouples report metal temperatures quickly and dependably. They aid in eliminating casting flaws, and sound, strong, dense castings result.

The use of Marshall Thermocouples also speeds casting operations and lowers production costs. They eliminate the misruns, cold shuts, sponginess, and excessive shrinkage caused by underheating or overheating the metals. Rejects are minimized and the scrap pile diminishes. Write for descriptive literature.

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270 W. Lane Ave. Columbus 2; Ohio

Marshall ENCLOSED-TIP THERMOCOUPLES

CIRCLE NO. 118, PAGE 81-82

foundry trade news

Grede Foundries, Inc., has purchased the **Elkhart Div., Chicago Hardware Foundry Co.** This, the company's seventh foundry, located at Elkhart, Ind., will specialize in small, high quality gray iron castings. The purchase was made to help meet the expanding demand for castings.

W. W. Sly Mfg. Co., Cleveland, has expanded its engineering and service facilities in the New England area with the opening of a new branch at Springfield, Mass. Joseph Sharkey will serve as district sales engineer.

Second quarter earnings of **American Brake Shoe Co.**, New York, were 127 per cent ahead of second quarter earnings last year, according to a report to stockholders. Earnings after taxes amounted to $1,752,941, equal to $1.40 per common share after preferred dividends, compared to $773,400, or 52 cents per common share, in the second quarter last year.

Interlake Iron Corp., Cleveland, for the first half of 1955, showed net sales and other revenues as $48,255,968, and net income as $4,002,786, equal to $2.05 per common share. In the first half of last year, sales and revenues were $31,657,768, and net income was $1,229,881, or 63 cents per share.

Stevens H. Hammond was re-elected chairman of the board and J. A. Handley was re-elected president of the **Whiting Corp.**, at the annual meeting held in Harvey, Ill. All other officers and directors of the firm were also re-elected at the meeting.

Mr. Hammond, in presenting the annual report, pointed out that lessened demand for heavy equipment caused a considerable drop in new orders and net shipments.

Earnings on the common stock (after dividends on preferred stock) amounted to $1.19 per share compared with $2.80 per share for the previous year (on a smaller number of shares). Dividends paid on the common amounted to $1.00 per share, the same as for the previous year.

Fanner Manufacturing Co., Cleveland, designers and manufacturers of chaplets and chills, has set up a Technical Service Division. Development work will be centered in the division which will also be available for consultation on castings production.

E. J. Lavino & Co., has moved its offices from 1528 Walnut, Philadelphia to Three Penn Center Plaza, Philadelphia.

Basic Refractories, Inc., Cleveland, has purchased the White Rock, Ohio, Gibsonburg, Ohio, and Buffalo, N. Y. plants of the **Kelley Island Co.**, Cleveland, together with related dolomite deposits, business, inventories, company name, patents and trademarks. The Kelley Island properties will be operated as a separate division of Basic under its present management.

Johnson-March Corp., Philadelphia, has appointed 11 new manufacturers' agents to distribute the company's dust control equipment in foundries and metal-producing industries.

Progress Pattern & Foundry Co. and **Garske Permanent Mold, Inc.**,

have been consolidated into one St. Paul, Minn., corporation known as **Progress Foundries, Inc.** All outstanding obligations of the two firms will be assumed by the new corporation. No changes in personnel have been made.

Cooper Alloy Corp., Hillside, N. J. has published a 16-page stainless steel Engineering Data Book. Compiled for use as part of the new Cooper Alloy catalog, the Engineering Data section includes design and dimensional information on flange drilling templates, flanges and ring-joint facings, and others. Available free on request to Public Relation Div.

The first meeting of creditors in the bankruptcy proceedings of the **Malleable Fittings Co.** was held in the Federal Building, Los Angeles July 26.

Linde Air Products Co., Div., Union Carbide & Carbon Corp., is building a $15 million silicone plant at Long Reach, W. Va., which is scheduled to go into production later this year.

Alloy Steel Castings Co. has moved from Willow Grove, Pa., to a new plant at nearby Southampton. New equipment and facilities of the Southampton foundry will double capacity for production.

Foxboro Co., Foxboro, Mass., has signed the Japanese firm of **Yokogawa Electric Works, Ltd.**, Tokyo, Japan, to manufacture and sell the full Foxboro line, as well as its own electrical strip chart instruments.

Product Design Studies No. 67, published by the **Steel Founders' Society of America**, Cleveland, lists the members of the Society and includes a quiz on steel castings.

National Malleable & Steel Castings Co., Cleveland, is dissolving its wholly owned subsidiary **Capitol Foundry Co.**, Phoenix, Ariz., which will be operated as **Capitol Foundry Div. Arizona Iron Works**, a former subsidiary of Capitol had already been absorbed by that company. As Capitol Foundry Div.

better shell molding...

When shell molding was introduced to this country in 1947, Plastics Engineering Company was quick to realize the great potential of this new process. A laboratory was equipped to manufacture shell molds, special machinery was designed and fabricated and an intense research program was launched. The results of this research and the experience gained is available to you at your request.
Write or call and one of Plenco's engineers will give you whatever technical advice and assistance is necessary to help you solve any plastics problem you might have.

PLASTICS ENGINEERING COMPANY
Sheboygan, Wisconsin

PLENCO PHENOLICS
FOR BETTER PLASTIC PRODUCTS

CIRCLE NO. 98, PAGE 81-82

of National Malleable, it will continue to produce grinding balls and steel and gray iron castings for the mining industry in the Arizona district.

E. A. Spring, president of Capitol Foundry, will continue as general manager of the division. B. J. Aamodt will be works manager and J. F. Thomas will be sales manager. National Malleable purchased Capitol in the spring of 1952 and has since built a new plant on Kyrene Drive near Tempe.

Directors of National Malleable have declared a dividend of 50 cents a share on common stock, payable September 10 to stockholders of record at the close of business August 15.

H. C. Gollmar was elected president of the **Elyria Foundry Div., Industrial Brownhoist Corp.,** Elyria, Ohio. His election coincided with the 50th anniversary of the foundry which was celebrated June 9. Gollmar joined the company in 1911 as a patternmaker apprentice, and in recent years has been vice-president and general manager.

The firm published a two-color 28-page, 50th anniversary booklet illustrating the company's operations and including photos of the company's personnel. To commemrate the occasion the firm invited all of its customers in for a plant tour June 9, followed by a dinner in the evening.

A new $1,250,000 addition for the manufacture of shell molded castings has been completed and is now in production at **Lynchburg Foundry Co.,** Lynchburg, Va. The addition, located at the company's Lynchburg works, is designed to produce gray and ductile iron castings by shell molding on a mass production basis. Unit contains 14 shell molding stations and complete core facilities with capacity for producing more than 100 tons of castings per day. Two new cupolas have also been installed.

J. Wesley Cable, consulting engineer has opened new offices at Judd Road, Monroe, Stepney Depot P. O., Conn.

American Wheelabrator & Equipment Corp., Mishawaka, Ind., has changed its corporate name to **Wheelabrator Corp.** The move does not involve any change in ownership, management or operation of the company.

Walworth Co., Kewanee, Ill., manufacturer of valves and fittings, will shut permanently its malleable foundry because of insufficient orders. The shutdown, which will be gradual, started August 15.

Meehanite Metal Corp., New Rochelle, N. Y., has prepared a wall chart containing the complete design and engineering properties of the various types of Meehanite castings available to industry. Chart measures 26 x 21 in. and includes basic facts about the metallurgy of Meehanite castings as well as graphs showing the effect of mass influence upon strength.

obituaries

Robert E. Kennedy, 68, secretary emeritus of the American Foundrymen's Society died of a heart attack August 7 (see page 78).

Peter J. Soffel, 63, founder of the Pittsburgh Metals Purifying Co., Pittsburgh, died recently. He organized the firm in 1927 and eight years ago, developed a process which reduces the cost of making aluminum castings.

C. Howard Paul, 61, who rose from a clerk to vice-president, secretary, and treasurer in 38 years with Macintosh-Hemphill Co., Pittsburgh, died recently following a heart attack. When Mackintosh became a division of the E. W. Bliss Co., Canton, Ohio, on May 1, Mr. Paul was appointed assistant treasurer for the entire Bliss organization.

Frank B. Stoner, connected with the Baker-Raulang Co. for almost a half century, died recently at his home in Peninsula, Ohio. He was instrumental in development of the electric fork lift truck as it is known today.

Harold Everett Hall, 45, president of Metals Disintegrating Co., Inc., Elizabeth, N. J., a subsidiary of American-Marietta Co. died recently. He served as president and director of the firm his father founded, from 1943 until his death.

William T. Koken, Chairman of the Board, Banner Iron Works, St. Louis, died recently.

Harold L. Martin, vice-president, and general manager of Atlas Foundry & Mfg. Co., Richmond, Calif., died recently.

John D. Hysong, Chicago district sales manager for Basic Refractories, Inc., Cleveland, died in Pittsburgh, Pa., following a short illness.

Cut foundry operating costs . . .

Transite Core Plates are strong and durable . . . resist warpage, impact and abuse, provide long service life.

with Transite Core Plates and Slip Jackets

"Johns-Manville Transite* Core Plates help assure maximum production in minimum time"—that's the experience of foundrymen who have used them for years. Made of asbestos and cement, they are light in weight, yet strong and durable. Being non-metallic, they resist corrosion, maintain their smooth surface and can be easily cleaned.

Transite Slip Jackets are a companion product with similar advantages. They do not burn, retain their original shape despite runouts. Slip jackets are furnished in both white and black types. The latter is widely used as a protective liner for metallic slip jackets.

FREE . . . New Folder gives complete details on Transite Core Plates and Slip Jackets—as well as Transite Pallite products for dielectric furnaces. For your copy of folder PP-31A, write Johns-Manville, Box 60, New York 16; in Canada, 565 Lakeshore Road East, Port Credit, Ontario.

Transite Slip Jackets cost less than other types . . . last longer, too. Result—important savings for foundries.

*Reg. U. S. Pat. Off.

JM PRODUCTS **Johns-Manville TRANSITE** CORE PLATES AND SLIP JACKETS

CIRCLE NO. 116, PAGE 81-82

afs chapter meetings

SEPTEMBER

8 . . St. Louis

York Hotel, St. Louis. F. H. Hohn, Scullin Steel Co., *"Improving Casting Quality by Non-Destructive Testing."*

8 . . Northeastern Ohio

Tudor Arms Hotel, Cleveland. Spencer Irwin, foreign editor of *Cleveland Plain Dealer*, *"World Trade Impact on Cleveland."*

9 . . Southern California

Rodger Young Auditorium, Los Angeles. Ray Olson, Shell Process, Inc., *"Jobbing With Shell Cores and Shell Molds."*

12 . . Cincinnati District

Cincinnati Club, Cincinnati. H. J. Heine, technical director of American Foundrymen's Society, *"Effect of Gating Design on Casting Quality."*

12 . . Northern California

Spenger's Restaurant, Berkeley. Ray Olson, Shell Process, Inc., *"Jobbing With Shell Cores and Shell Molds."*

16 . . Texas

Ben Milam Hotel, Houston. Film: *"Study of Fluid Flow of Light Alloys Through Vertical Gating Systems."*

17 . . Birmingham District

Cascade Plunge, Birmingham, Ala. Twenty-Second Annual Outing.

20 . . Twin City

Covered Wagon, Minneapolis. Norman Qualey, Northern Ordinance, Inc., *"Inspection Tools For the Foundry."*

21 . . Central Michigan

Marywood Country Club, Battle Creek. Harry Gravelin, Claude B. Schneible Co., *"Why Not?"*

21 . . Oregon

Heathman Hotel, Portland. Ray Olson, Shell Process, Inc., *"Jobbing With Shell Cores and Shell Molds."*

23 . . Eastern Canada

Three Rivers Technical School, Three Rivers, Que. Eight Plant Visits.

23 . . Chesapeake

Newport News Shipbuilding & Drydock Co., Newport News, Va. Plant Visitations.

OCTOBER

3 . . Metropolitan

Essex House Hotel, Newark, N. J. Dorian Shainin, Rath & Strong, Inc., *"Quality Control in Foundry Operations."*

Under the table pay-off

. . . or what Chuck Wright recommends for a grinder's bed

"Tim's got a bigger bankroll now and he's entitled to it," asserted Chuck Wright.

Chuck, the INCO distributor foundry specialist, was speaking about Supt. Tim Dineen of the Webb Foundry.

"Webb's customers seldom rejected a casting," declared Chuck. "Until a couple of months ago, when the foundry got an order for grinder beds.

"Tim called our office and said he was holding a bear by the tail. He really was. Because composition, pouring temperature, sand condition . . . everything appeared to be under control. Yet when the customer got those grinder beds, he ran into hard edges and poor machinability in the lighter sections of the T-slots.

"So I drove out to see a reject, first hand. It didn't take me long to see that foundry practice alone couldn't solve the problem. Foundry control provided density of the heavy sections but it cannot give the essential uniformity and machinability in both light and heavy sections.

"Grinder beds and the like . . . with light and heavy sections . . . must be machinable throughout. And there's nothing like a little nickel to improve the uniformity of structure all through a casting, consistently.

"After Tim added 1% nickel to his mix, results added up to more than he expected. Now the customer gets machinability in the light sections, and a dense close grained structure in heavy sections. Properties and service performance are also improved. Another result is the new figure on Tim's paycheck. What it is . . . that's for him to say.

"Sometime you may run into a problem that involves the metallurgy of castings. Whenever that happens, I'll be glad to help you, too."

Chuck Wright

P.S. Just drop me a line in care of INCO.

INCO

The International Nickel Company, Inc.

67 Wall Street New York 5, N.Y.

Get Down to Earth at Missouri Regional Foundry Conference

■ "Practical Ideas and Down-to-Earth Know-How for Foundry Management, Supervisors and Foremen" is the theme of the Missouri Valley Regional Conference, September 29-30, at the Missouri School of Mines & Metallurgy, Rolla, Mo.

Sponsored by the St. Louis, Mo-Kan (Kansas City), Tri-State (Tulsa) Chapters, and the MSM Student Chapter, the conference is under the general chairmanship of Webb L. Kammerer, Midvale Mining & Mfg. Co., St. Louis. Honorary chairman is Dean Curtis L. Wilson, Missouri School of Mines & Metallurgy. Program chairman is F. J. Boeneker, Bronze Alloys Co., St. Louis.

Rooms have been set aside at the Pennant and the Edwin Long Hotels, Rolla, and conference attendants are urged to make their reservations direct and early.

Thursday, September 29

9:00 am .. REGISTRATION

10:00 am .. OFFICIAL CONFERENCE OPENING, Webb L. Kammerer
ADDRESS OF WELCOME, Dean, Curtis L. Wilson
CONFERENCE PROGRAM & PROCEDURES, Fred J. Boeneker

10:30 am .. GENERAL MEETING. *"New Horizons in Foundry Progress,"* Hans J. Heine, AFS technical director, Des Plaines, Ill.

12:15 pm .. LUNCHEON

2:00 pm .. GENERAL MEETING. *"Can Shell Cores Help You?"* W. J. White, Shallway Corp., Connellsville, Pa.

3:30 pm .. SECTIONAL MEETINGS
Gray Iron .. *"Practical Approach to Quality Control in the Gray Iron Foundry,"* Charles F. Walton, technical director, Gray Iron Founders' Society, Cleveland
Steel .. *"Steel Casting Design,"* William T. Bean, Jr., Detroit
Non-Ferrous .. *"Practical Gating & Risering of Non-Ferrous Castings,"* R. A. Colton, Federated Metals Div., American Smelting & Refining Co., Barber, N. J.

5:30 pm .. OZARK HILLBILLY JAMBOREE

Friday, September 30

9:00 am .. GENERAL MEETING. *"Practical Mechanization for Small Foundries,"* C. V. Nass, Beardsley & Piper, Div. Pettibone Mulliken Corp., Chicago.

Webb L. Kammerer

10:30 am .. SECTIONAL MEETINGS
Gray Iron .. *"Proper Heat Treatment of Gray Iron Castings to Develop Maximum Properties,"* C. R. Austin, Meehanite Metal Corp., New Rochelle, N. Y.
Steel .. *"Steel Castings vs. Forgings,"* J. B. Caine, foundry consultant, Wyoming, Ohio.
Non-Ferrous .. *"Economics of Quality Control in the Bronze Foundry,"* Harry C. Ahl, Jr., National Bearing Div., American Brake Shoe Co., Meadville, Pa.

12:15 pm .. LUNCHEON

2:00 pm .. CONFERENCE ADJOURNMENT

DUREGZ

for BETTER—FASTER—CHEAPER

CUPOLA LINING REPAIRS

DUREGAN, when applied pneumatically with air guns to the melting zone of the cupola, enables the replacement of the burned out lining to be made in the shortest possible time with a minimum amount of drop-off.

DUREGAN is a silicious mixture prepared from carefully selected and washed Quartz pebbles and sands thoroughly coated with high quality Plastic Fire Clay and other bonding agents. The thoroughly coated Silica grain induces the cementing action which firmly holds the Quartz pebbles into place with minimum rebound. Operating cupola temperatures develop the necessary ceramic bond that welds this applied mass into a strong, dense lining.

DUREGAN is screened to meet the requirements of all standard equipment now employed for this type of cupola lining. Shipments are made either in multiwall bags or in bulk, as the customer specifies.

DUREX
REFRACTORIES CO.
JACKSON, OHIO

CIRCLE NO. 112, PAGE 81-82

Study Castings Industry Manpower Needs

Castings industry manpower needs of the coming two decades and how to meet them were discussed July 20 at the first meeting of its type held at the U. S. Bureau of Apprenticeship. In the group that set up a survey to determine the skills foundries want in their workers, how many workers they need, and what training techniques have been most effective were (seated): Cal C. Chambers, president, Texas Foundries; Fred G. Sefing, metallurgist, International Nickel Co., committee chairman; Walter J. Klayer, works manager, Aluminum Industries, Inc.; and B. C. Yearley, engineering assistant to vice-president, National Malleable & Steel Castings Co. Standing left to right are: John S. McCauley, research & statistics chief, Bureau of Apprenticeship; W. C. Christensen, deputy director, Bureau of Apprenticeship; Herbert F. Scobie, editor, MODERN CASTINGS; Wm. J. Moore, assistant director, Bureau of Apprenticeship; F. G. Steinebach, editor, Foundry; and Richard Brown, Bureau of Apprenticeship.

Speaker List Available

Speakers on every foundry subject are listed in the 1955-56 edition of the *AFS Chapter Speaker List*, recently released by the American Foundrymen's Society.

All of the 240 names included in this list were selected both as a result of past performance as well as from evaluation reports received from AFS chapters during the year. In addition, the names of certain authors of technical papers presented at the last convention of the Society have been listed.

To obtain a copy of the *1955-56 AFS Chapter Speaker List*, write: American Foundrymen's Society, Golf & Wolf Roads, Des Plaines, Ill.

How to Maintain and Test Dust Collecting Systems

How an adequate, scheduled maintenance program for foundry ventilating and dust collecting systems will pay for itself is told in Section 11, "Maintenance and Testing," of the forthcoming ENGINEERING MANUAL FOR CONTROL OF IN-PLANT ENVIRONMENT IN FOUNDRIES.

Because effective maintenance is more easily accomplished when the installation is planned for convenient cleaning and removal of any part of the system, much of the data pertain to design of exhaust systems.

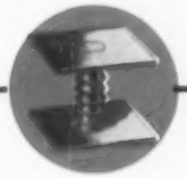
One rule to follow is to establish a routine procedure for inspection and care. This involves providing maintenance men with adequate information about the systems.

Exhaust hoods, ductwork, and fans are discussed separately, as are different types of dust collectors.

Testing instruments covered include those for measuring air pressures and velocities in pipes, and those for measuring air flow into hoods and enclosures. Testing procedures are given for each instrument. Methods involving elaborate equipment are not included.

Fourteen pages, 8½ x 11, illustrated, and paper-bound "Maintenance and Testing" may be obtained from the Book Department of American Foundrymen's Society, Golf & Wolf Roads, Des Plaines, Ill.

Chaplets, an old STAND-BY become a greater PROFIT-MAKER for the foundryman *through a new Field Technical Service*



Throughout the foundry field in the past fifty years, wherever hollow cored castings were made, foundrymen generally accepted chaplets as necessary to the job. Small in comparison with the casting itself, they were used by the thousands day after day with little thought being given to the vital function these mighty mites of metal actually performed.

But today, foundries — both ferrous and non-ferrous — are looking at chaplets in an entirely new light!

The demand for better and lower cost products . . . the increased competition from other methods of fabrication have brought foundrymen face to face with the problems of producing more intricate castings with increased strength, closer tolerances, less machining and finer finish.

Research in castings proved that the planned, careful and accurate use of properly designed chaplets could readily result in any combination of the above qualities — far more intricate castings with less finishing at lower cost — a cost which could enable the foundryman to produce at a real profit!

Fanner, because it designed most of the chaplets and chills used throughout industry today, worked closely with many types of foundries in this development work. Now, realizing that it has a great wealth of valuable information on hand, and that now, more than ever before, foundries of all types can use this information to better their output and increase their profits, Fanner is setting up a new Technical Service Division which can provide a vital service, at no cost, to producers of both ferrous and non-ferrous castings.

This Technical Service Division will continue with its development work to give foundrymen the production advantages with which to meet future competition . . . and it will be available for consultation on producing castings with qualities which will bring about greater sales potentials and greater resulting profits.

The service of this division is available upon request and without obligation. Simply direct your inquiries to the address shown below.

THE FANNER MANUFACTURING CO.

BROOKSIDE PARK **CLEVELAND 9, OHIO**

ESTABLISHED 1894

Designers and Manufacturers of Fine Fanner Chaplets and Chills

CIRCLE NO. 92, PAGE 81-82

Feature Small Shop at New England Regional

■ Operations of a six to 16 molder foundry will form the basis for papers at the New England Regional Foundry Conference to be held at the Massachusetts Institute of Technology, October 14 and 15. The conference is sponsored by the New England Foundrymen's Association in cooperation with MIT.

General conference chairman is Henry G. Stenberg, Draper Corp., Hopedale, Mass.; ferrous program chairman is Clyde Armstrong, Warren Foundry & Pipe Corp., Everett, Mass., and the non-ferrous program co-chairmen, Frank Volpe, Somerville Machine & Foundry Co., Somerville, Mass., and Julius Ferrari, Gorham Mfg. Co., Providence, R. I.

Friday, October 14

9:00 am . . Registration
9:45 am . . Opening Address, Henry G. Stenberg
10:00 am . . Address of Welcome, G. Richard Soderberg, Dean of Engineering, MIT
10:15 am . . Ferrous and Non-Ferrous Session. *"Green Sand Casting Finish,"* Raymon F. Meader, Whitin Machine Works, Whitinsville, Mass.
1:30 pm . . Ferrous Session. *"The Effect of Gases and Trace Elements on Cast Iron,"* Fred C. Barbour, Republic Steel Corp.

Henry G. Stenberg

1:30 pm . . Non-Ferrous Session. *"Crucibles and Refractories: Their Care and Maintenance,"* George H. Caligan, American Refractories & Crucible Corp., North Haven, Conn.
3:00 pm . . Ferrous Session. *"Economical Mechanization of Small Foundries,"* Chester Thomas, National Engineering Co., Chicago.
3:00 pm . . Non-Ferrous Session. *"Manganese and Aluminum Bronze Foundry Practice,"* Charles V. Knobeloch, R. Lavin & Son, Inc., Chicago.
6:30 pm . . Conference Dinner, MIT Faculty Club

Saturday, October 15

8:00 am . . Registration
9:00 am . . Ferrous and Non-Ferrous Session. *"Casting Defects,"* W. A. Hambley, Charles A. Krause, Milling Co., Milwaukee.
10:30 am . . Ferrous Session. *"Some Aspects of Sand Practices for the Small Foundry,"* William G. Parker, General Electric Co., Schenectady, N. Y.
10:30 am . . Non-Ferrous Session. *"Plaster Molding,"* Julius Ferrari, Gorham Mfg. Co., Providence, R. I.
1:45 pm . . Ferrous and Non-Ferrous Session. *"Gating and Feeding,"* Michael Bock II, Exomet Corp., Conneaut, Ohio.
3:45 pm . . Conference Closes.

Traditional windup of the New England Regional Foundry Conference, the Foundrymen's Smoker, is expected to be staged again on the Parker House Roof in Boston.

METALLURGICAL CHEMISTS

- *Chemical Analysis*
- *Spectographic and Fluorescent X-Ray*
- *Physical Testing*
- *Metallographers*
- *Foundry and Metallurgical Consulting*

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431 S. Dearborn St. Chicago 5, Ill.

Since 1903

Circle No. 117, page 81-82

"OLIVER" JIG SAWS

cut pattern costs

No. 173E JIG SAW cuts patterns up to 9" thick with accuracy. Table turned ⅛th way around to increase capacity; tilts 30° to right or left. New tension device insures smoothest work. Controlled by foot-lever.

No. 173S JIG SAW has upper tension unit mounted on ceiling for unlimited capacity. Table is 73" or 34" square. Also cuts light metals.

Write for Bulletins

OLIVER MACHINERY COMPANY
GRAND RAPIDS 2, MICHIGAN

Circle No. 120, page 81-82

EMPIRE

"THAT GOOD"

FOUNDRY COKE

DeBardeleben Coal Corporation

2201 First Ave., North Birmingham 3, Ala.
Phone 3-9135

Circle No. 110, page 81-82

Northeastern Ohio AFS Group Holds Outing

HAROLD WHEELER, ALLYNE-RYAN FOUNDRY CO.

Northeastern Ohio . . Part of the group waiting for the drawing of prizes at the golf outing held June 25 at Twin Lakes Country Club.

Choose Better Castings Theme For Ohio Regional Conference

"Better Castings for Better Living" is the theme around which some 20 speakers will develop their talks at the Ohio Regional Foundry Conference in Cleveland, October 20 and 21. Sponsored by the Central Ohio, Canton District, Cincinnati District, Toledo, and Northeastern Ohio Chapters of the American Foundrymen's Society, along with the Ohio State University Student Chapter and Case Institute of Technology, the two-day conference will be held at Case. All sessions and two luncheons are scheduled for Tomlinson Hall. Banquet the evening of October 20 will be held in nearby Tudor Arms Hotel.

General chairman of the conference is L. T. Crosby, Sterling Wheelbarrow Co.; program chairman is A. D. Barczak, Superior Foundry Co.

Program has been developed around four sets of four concurrent sessions on gray iron, malleable, steel, and non-ferrous subjects, along with two luncheon talks, a banquet address, and a final general session on patternmaking. Technical discussions will include shell molding, cupola operation, safety, refractories, steel melting, non-ferrous sands, casting defects, high pressure molding, exothermic and insulating materials, castings versus forgings, cleaning, risering, gating, and CO_2-water glass bonding of sand.

Indian Founders Issue Journal

First edition of the *Indian Foundry Journal*, official organ of the Institute of Indian Foundrymen, was released May 1955. Approximately 8½ x 11 in. in size, the *Journal* includes technical articles, news of the institute, and personal and plant news.

IIF was organized in 1950 and has been active in developing training courses and a committee to study indigenous foundry sands. The institute is a member of the International Committee of Foundry Technical Associations and has had representatives at a number of International Foundry Congresses.

TAYCOR CAN TAKE IT

TAYCOR brick bottom still going strong after 1½ years where fireclay fails in from 1 to 8 months!

The forge furnace shown above is one of many operated by a prominent manufacturer of forgings in the Chicago area. Steel pieces, weighing from 50 to 450 lbs., are pushed onto the furnace bottom and are withdrawn the same way. Due to this severe service, fireclay bottom life averaged from one to eight months.

Because of their excellent resistance to heat, abrasion and attack from iron oxide, TAYCOR Brick were installed in this furnace bottom. After more than 1½ years, the TAYCOR bottom was *still in good condition*. There was no grooving—the wear was even throughout—attesting to the abrasion resistance of TAYCOR. As a result, this customer has installed TAYCOR in other furnace hearths.

TAYCOR is The Chas. Taylor Sons Co. trade name for a complete line of corundum-base (alumina) super-refractories. It will pay you to look into the advantages of TAYCOR for similar applications. Contact the Taylor Field Engineer in your area, or write direct for full details.

Exclusive Agents in Canada:
REFRACTORIES ENGINEERING AND SUPPLIES, LTD.
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The CHAS. TAYLOR SONS Co.
A SUBSIDIARY OF NATIONAL LEAD COMPANY
REFRACTORIES SINCE 1864 • CINCINNATI • OHIO • U.S.A.

CIRCLE NO. 88, PAGE 81-82

BARGAINS IN FOUNDRY EQUIPMENT

AIR COMPRESSORS

Chicago Pneumatic 50 HP direct motor driven Type P-4.

Chicago Pneumatic 2 stage horizontal 24" x 14" x 18". 3600 CFM 800 HP 2200V. Synchronous motor, M.G. set, Intercooler, Aftercooler and starting panel.

BLOWERS

General Electric 7500 CFM, 20 oz., 89.6 max. HP, 220V motor, Airways controls.

Ingersoll-Rand turbo compressor 10500 CFM @ 20 oz. 85 HP G.E. 220V 3500 CFM motor.

CLEANING EQUIPMENT

Sly 8' dia. Table Shot Blast Unit.

36 x 42 Halloway 7½ HP shot motor elevator and dust collector.

CORE BLOWERS

3—International SB 12.
4—International SB 13.
1—Osborn 93.
12—Osborn 193.
1—Osborn 2035-2.
1—Peterson (Similar to Demmler #50).

CORE OVENS VERTICAL HORIZONTAL

1—Coleman, combination oil or gas fired 43 carriers 24" x 90"—1 hour 12 min. to 4 hours 48 min. cycle.

1—Coleman, combination oil or gas fired 43—2 shelf carriers 30" x 144" long. 2 hour 12 min. to 7 hour 24 min. cycle. Present replacement cost over $90,000.00.

GRINDERS, SNAGGING

5—Hammond 10 W R I Double End Snag. Grinders 20" dia. wheels, 10 HP 220/440V motors, variable speed drives.

3—3" x 24" U.S. #65, 20 HP 220/440V.

MOLDING MACHINES

Jolt Squeeze Pin Lifts:

2—International PK 20's, 20" squeeze cylinder 8" draw. Ser. #67237. New 1949.

1—Milwaukee 126-3 Jolt Squeeze Pin Stripper, 27" x 21" Table, 8" draw.

OVENS, MOLD OR CORE

Porbeck Double Car Single 16' long 14' wide 9' high gas fired 600° recirculating complete with 7½ HP car puller. In place St. Louis, Mo.

Core oven Electric 68" x 42" high, 65" deep 100°—650°.

POURING DEVICES

13—Pouring Devices, Whiting 750# and 1500#.

ROLLOVERS

Jolt Rollover Pattern Draw:

1—Herman 4000# Series 30" x 60" table, 32" x 48" bumper.

1—Herman 3000# Series 40" x 84" table, special slotted table.

1—Herman 1500# Series 20" x 36" table.

2—Herman 750 Series 20" x 30" table.

2—Herman 750# Series 20" x 24" table.

All the above have air clamps rollout tables.

2—Champion JM-18-8 Jolt Rollovers, portable 13½" x 20" tables.

1—Davenport 24 SA Jolt Rollover Pattern Draw. 26" x 42" flask size, 12" draw.

SAND SLINGER

B&P Stationary Slinger with bucket elevator to 10' x 10' x 6' sand storage bin, conveyor, feeder to double belt head 19" head single speed.

ACME

ACME EQUIPMENT CO., INC.

We will buy for cash a single piece of equipment or your entire foundry

125 South Clinton Street • Phone: ANdover 3-3430 • Chicago 6, Illinois

MONA

2 BUCKET CONVEYORS 56' CENTERS: 8 ply x 20" belt, 18" x 8" x 7" buckets complete with drives.

4 STEEL APRON CONVEYORS: 1-120' centers x 36" wide Midwest, 1-57' centers x 30" wide Palmer-Bee "Kantleak" variable speed, 1-44' centers x 30" wide Link-Belt, 1-19' centers x 30" wide Palmer-Belt, 1-5'6" centers x 30" wide Palmer-Belt.

FLAT BELT CONVEYOR: 2-30" x 45' x 110', 1-36" x 35'.

TROUGHING CONVEYOR: 1-18" x 100'.

BELLEVUE ANNEALING FURNACE: Oil-fired—all controls Box type 36" wide x 72" deep x 24" high overall 69" wide 88½" deep, 71" high, height clearance required 10'.

LARGE MOLDING MACHINES:

Davenport 40A, 40SA, 34SA, 28SA, 34AJS

Johnston & Jennings 815

Herman 40" x 60" 6000 lbs.

Osborn 405-95 — 26" draw

Jolt Squeeze Strip — Nichols 24-54D

Jolt Pin Lift — Davenport, Nichols, Osborn, Spo, Milwaukee, Herman

We carry all makes and types of foundry equipment in stock. SEND FOR OUR COMPLETE LISTING.

FOR SALE: **One complete gray iron foundry,** 18000 sq. ft., #7 Whiting Cupola, located 80 miles south of Cleveland.

We buy and sell complete foundries. **Telephone: Glenville 1-1222**

GUARANTEED USED FOUNDRY EQUIPMENT

classified advertising

For Sale, Help Wanted, Personals, Engineering Sevice, etc.,

set solid . . 20c per word, 30 words ($6.00) minimum, prepaid.

Positions Wanted

. . 10c per word, 30 words ($3.00) minimum, prepaid. Box number, care of **Modern Castings,** counts as 10 additional words.

Display Classified

. . Based on per-column width, per inch . . 1-time, $15.00; 3-time, $13.50 per insertion; 6-time, $12.50 per insertion; 12-time, $12.00 per insertion; prepaid.

HELP WANTED

METALLURGIST. Experienced in cast iron and foundry practice. Prepared to travel. State salary required and full qualifications. **Box C53,, MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.**

We want several live-wire salesmen who are now working on salary and who think that they could increase their earnings by selling on liberal commission. These men must have followings in industries buying master alloys and hardeners. Please give full details in your first letter, i.e., personal history, employment record, territory, etc. Your information will be held in strictest confidence. **Box C58, MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.**

Opportunity with active established Foundry Supply firm, for aggressive young man with ability to formulate and help sell a top quality line of Binders, Washes, Ladle Lining Paste, Parting, etc. Profit sharing basis available. **Box C59, MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.**

FOUNDRY METALLURGIST Capable foundry metallurgist preferably with some nonferrous experience, is needed for a challenging and creative research assignment. Here is an opportunity for a man with real ability to advance in a rapidly expanding organization. Attractive salary and liberal benefits including generous tuition refunds for graduate study. Contact: **Mr. T. E. DePinto ARMOUR RESEARCH FOUNDATION of Illinois Institute of Technology 10 West 35th St. Chicago 16, Illinois.**

METALLURGIST OR METALLURGICAL ENGINEER, recent graduate, needed for manufacturing research laboratory of progressive steel castings company in midwest. Opportunity to do applied research and pilot plant work on metallurgy of cast steels, development of new molding techniques and casting processing methods. Experience useful but not essential. In reply indicate educational background, military status and experience. **Box C62, MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.**

POSITIONS WANTED

PATTERN SHOP SUPERVISOR. Qualified to supervise wood and metal pattern shop and pattern storage. Thoroughly familiar with pattern and core blower rigging. Experienced in modern foundry techniques. 25 years pattern and foundry know-how. Will relocate. **Box C56, MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.**

QUALITY CONTROL REPRESENTATIVE. For large industrial plant or engineering firm. Thorough knowledge of qualitative and dimensional inspection for heavy castings. Fully qualified to act as project engineer in charge of manufacture and erection of heavy equipment and machinery. Have handled foreign and stateside assignments. Knowledge of government specifications and procedures. Excellent references. **Box C57, MODERN Castings, Golf and Wolf Roads, Des Plaines, Ill.**

METALLURGICAL ENGINEER. BS degree, age 34, married, family. Thirteen years diversified production and process development supervisory experience in founding of light alloys, specializing in plaster molding, precision and high quality complex castings. Seeking responsible position with progressive foundry organization. Presently employed. **Box C60, MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.**

FOUNDRY SUPERINTENDENT OR MANAGER. 28 years practical experience ferrous and nonferrous, jobbing and production. Fully qualified to take complete charge all foundry operations. Iron by analysis, high and low carbons. Have held supervisory positions past 18 years, last 13 as superintendent. Age 46. Now employed. Excellent reasons for desiring change. New York State preferred. Complete data education and experience upon request. **Box C61, MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.**

FOR SALE

FURNACES FOR SALE

10 used Heat Treating Furnaces, and two 7-ton gantry cranes, good condition, priced to sell.

BAER STEEL PRODUCTS, INC.
Box 1428
Boise, Idaho

ENGINEERING SERVICE

EARL E. WOODLIFF,

Foundry Sand Engineer.
Consulting . . . Testing.
14611 Fenkell (5-Mile Rd.) Detroit 27, Mich.
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SESSIONS ENGINEERING CO.

Consulting Foundry Engineers
Modernization, Processing Layouts
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casting through the ages

USING DRY SAND MOLDS FRANCE WAS TURNING OUT 1,000,000 CAST IRON SHELLS A DAY IN 1917. AT THAT TIME A 4.7 INCH CAST IRON SHELL COST LESS THAN ONE-THIRD AS MUCH TO PRODUCE AS A SIMILAR SIZE STEEL FORGING.
MEDIAEVAL BELL FOUNDERS SOMETIMES CAST AN ENTIRE PEAL OF BELLS SO PERFECTLY TUNED ONE TO ANOTHER, THAT NO HAMMERING, CHISELING OR FILING WAS REQUIRED ON ANY ONE OF THE BELLS!
CAST IRON PARTS AND FITTINGS, MADE IN LATE 18th CENTURY PENNSYLVANIA FURNACES FOR USE IN MILLS BUILT IN OHIO AND OTHER WESTERN SECTIONS WERE TRANSPORTED OVER THE MOUNTAINS SLUNG OVER THE BACKS OF PACK HORSES OR HANGING AT THE ANIMALS' SIDES. THESE PACK HORSES, EACH CARRYING A LOAD OF 200 LBS, TRAVELED IN SINGLE FILE IN GROUPS OF 12 TO 15.
Odd Bits
AFTER SWITCHING FROM CHARCOAL TO COKE, ABRAHAM DARBY, FAMED 18th CENTURY IRON FOUNDER OF COALBROOKDALE ENGLAND, USED AS A FURNACE CHARGE, FIVE BASKETS OF COKE, TWO OF "COKE BREEZE" AND ONE OF PEAT. THEN HE TOSSED IN THE ORE, FOLLOWED BY THE LIMESTONE.

Here's a Dust Collector that cleans itself!

NO MOVING PARTS
. . . to wear or corrode within collection area.
NO INTRICATE PARTS
. . . to clean. Water action and glass spheres do the work!
SLUDGE CONVEYOR
. . . lifts out. Works at slow speed for top dewatering action.
NO DEAD AREAS
Entire interior is constantly flushed. Every inch is active to collect dust!

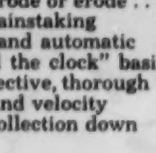
These exclusive features make the new Hydro-Filter virtually self cleaning... can make maintenance a matter of minutes a month:

New HYDRO-FILTER maintains constant efficiency because it's easy to maintain!

Ease of maintenance and constant efficiency go hand in hand with the new Hydro-Filter to give you your money's worth in *constant* service at rated capacity.

Air, water and glass spheres do the work in the Hydro-Filter. There are no parts within the collection area to corrode or erode . . . nothing to wear or "load up" requiring hours of painstaking maintenance. Continual flushing of the filter bed and automatic sludge removal make it self-cleaning on a "round the clock" basis. A constant automatic, air-water balance assures effective, thorough dust removal through a wide variation in volume and velocity of flow . . . your *answer* to maintenance-free wet collection down to the micron range.

Write for Bulletin 55
Describing the unique filtering principle which makes constant flow wet collection possible with the National Hydro-Filter



NATIONAL HYDRO-FILTER **Dust Collector Corp.**
601 Machinery Hall Bldg.,
Chicago 6, Illinois

Subsidiary of National Engineering Company, Manufacturer of Simpson Mix-Mullers.

CIRCLE NO. 119, PAGE 81-82

Plan Washington Publicity

■ Need for castings industry publicity in government circles was considered at the annual meeting of the National Castings Council July 15. A committee was set up to determine the nature and cost of the publicity effort. Other business included election of a new president and vice-president.

William L. Leopold

Bruce L. Simpson

Named president was William L. Leopold, Northern Bronze Co., Philadelphia. He is president of the Non-Ferrous Founders' Society.

Bruce L. Simpson, National Engineering Co., Chicago, president of the American Foundrymen's Society, was elected NCC vice-president.

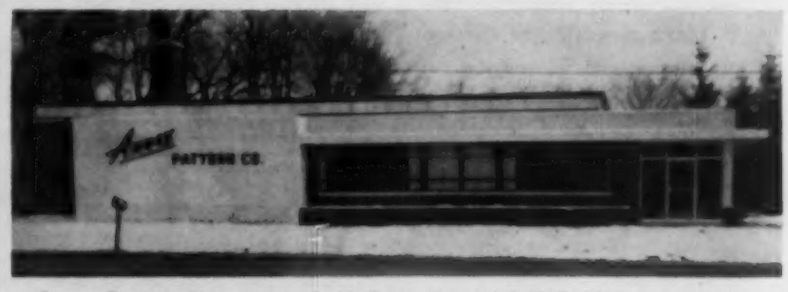
F. Ray Fleig, Smith Facing & Supply Co., Cleveland, and Frank G. Steinebach, *Foundry*, were re-elected treasurer and secretary, respectively.

The National Castings Council is made up of the president and a member of the board of directors of the following groups: Alloy Casting Institute, American Foundrymen's Society, Foundry Educational Foundation, Foundry Equipment Manufacturers Association, Foundry Facings Manufacturers' Association, Gray Iron Founders' Society, Investment Casting Institute, Malleable Founders' Society, National Foundry Association, Non-Ferrous Founders' Society, and Steel Founders' Society of America.

Looking . . .

. . . for new production ideas? Circle numbers on Reader Service cards (page 81-82) to get more information on products and services described in Products & Processes and For the Asking.

Operate New Pattern Shop in Detroit



Annex Pattern Co. partners R. H. Spengler and J. T. Smith, are operating from their 15,000 sq ft new plant, site of the judging of the 1955 pattern contest of the Detroit Chapter of the American Foundrymen's Society.

Plan Cupola Research

Radioactive tracer elements may be used in the study of the effect of cupola melting on chemical and physical properties of the metal, if recommendations made to the Cupola Research Committee of the American Foundrymen's Society are carried out.

The twelve-man committee, with Hyman Bornstein presiding, met in Houston, May 26, during Convention to plan committee projects. One recommendation concerned study of analysis control when melting with basic or neutral lined cupolas. Another, the investigation of the role of steel in cupola melting.

It was suggested that an European cupola development program to solve thermo and metallurgical problems of hot blast operation be followed, inasmuch as they are dealing with inferior raw materials and the United States may be faced with a similar problem in an emergency.

Solves Small Heat Problems

First of several preferred methods of investment melting which can minimize many of the more serious problems of small heats is knowing losses of elements for the given practice. This and the following are among recommendations by Dr. Nicholas J. Grant in an address to a recent New York meeting of the Investment Castings Institute:

Short-sheared, uniform stock of maximum density will help to avert bridging and resulting overheating of the bath. The charge should also be greaseless, dry, and free from oxide—preferably sandblasted or pickled.

Type 304 stainless steel should be used in place of Type 321, and it should be added as the charge melts so as not to chill the bath excessively.

Protective covers or inert gas atmospheres guard against oxidation in gas melting and hydrogen pickup in arc melting.

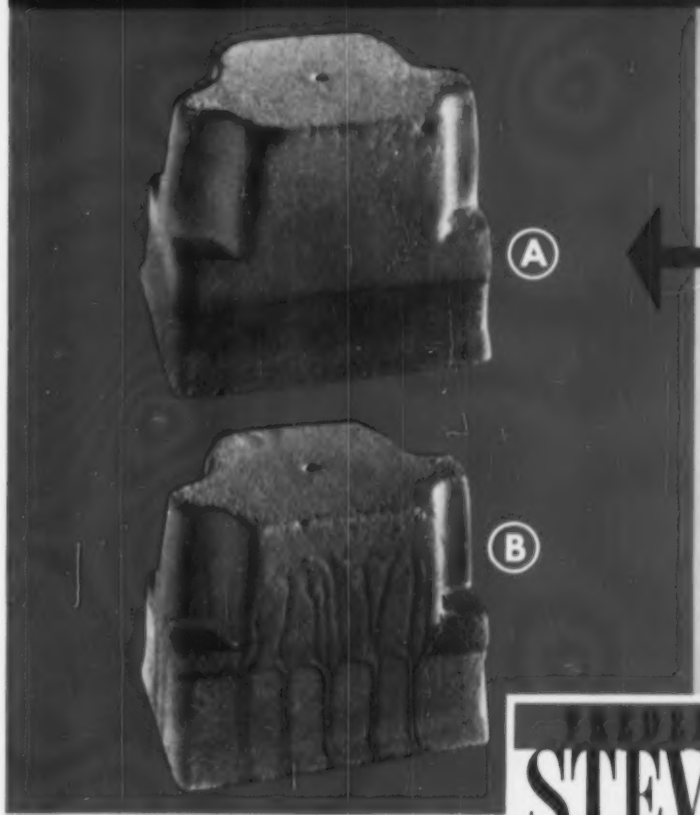
As soon as the charge is melted, check the temperature by the best means available to avoid overheating.

CIRCLE NO. 104, PAGE 81-82

THEY'RE NEW! THEY'RE DIFFERENT!

2 NEW STEVENS CORE COATINGS

FOR BETTER CASTINGS—AT LOWER COST



STEVENS GRAPH-KOTE

A GRAPHITE CORE COATING

The unretouched illustrations at the left show (A) a core that has been dipped in the new Stevens Graph-Kote Core Coating while (B) shows another core dipped in an ordinary core coating. Observe the difference between these two coatings. Stevens Graph-Kote shows no bleed, no run-down, no tear-drops, no build-up, while the other coating shows all of these defects. The new Stevens Graph-Kote produces better castings at lower cost when used on cores and molds for grey iron, non-ferrous and alloy castings. It produces a true grey iron color on castings.

STEVENS RED-SKIN

A REFRACTORY CORE COATING

Below are shown unretouched photographs of (C) a core dipped in the new Stevens Red-Skin Core Coating and (D) a similar core dipped in a standard type carbon-free core coating. Note the difference between these coatings. Stevens Red-Skin does not run, streak, tear-drop or pile up at the edge of the core. The other coating shows inferior application. The new Stevens Red-Skin reduces costs and aids in the production of better castings when used on molds and cores for steel, grey iron and non-ferrous. It is carbon-free and is highly refractory.

FREDERIC B. STEVENS INCORPORATED
EVERYTHING FOR A FOUNDRY

After months of research, formulation and testing in foundries under varied conditions, the Stevens Laboratories are proud to introduce two new and different core coatings — Stevens Graph-Kote and Stevens Red-Skin. Both have advantages to foundrymen.

Will Reduce Labor Cost: Since both Graph-Kote and Red-Skin are "short" they coat only where a coating is needed. The dip line is sharp. No run-downs, sags, tear-drops or build-up to clean from cores. Cores can be dipped faster, core prints and assemblies fit accurately and conveyors and oven racks are kept cleaner.

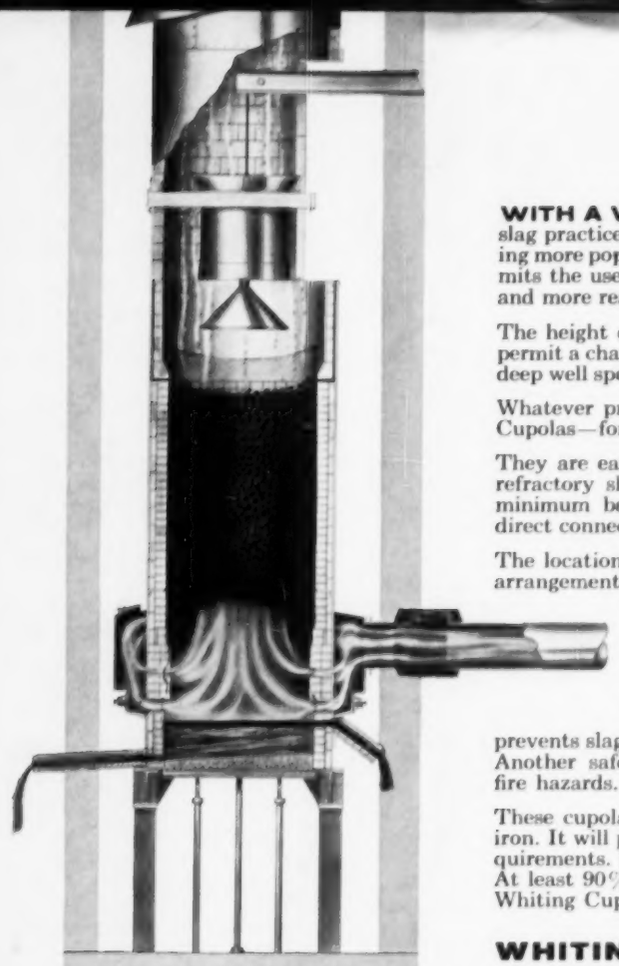
Both Have Deep Penetration: For protection against metal penetration Graph-Kote and Red-Skin seal several layers of sand to insure easy peel from castings. An even, uniform coating gives ample coverage to produce clean castings.

Are Tough and Rugged: Will withstand the most severe conditions of impinging and flowing metal since the coatings are firmly anchored to mold and core surfaces and are resistant to high pouring temperatures.

Other Advantages: Stevens Graph-Kote and Red-Skin form smooth, foam-free solutions. They are ready to use, with no waiting period, as soon as they are completely mixed. Can be stored indefinitely without deteriorating in polyethylene lined containers.

To get better castings at lower cost investigate Stevens Graph-Kote and Red-Skin Core Coatings today.

BRANCHES: BUFFALO • CLEVELAND • INDIANAPOLIS • NEW HAVEN



NOW! USE BASIC OR ACID SLAG PRACTICE!

WITH A WHITING CUPOLA you can use *either* basic or acid slag practice! Basic slag practice, while still somewhat new is becoming more popular because it makes possible a reduction in sulphur, permits the use of a greater percentage of steel scrap with less pig iron and more readily increases the carbon content of the metal.

The height of the tuyeres in the Whiting Cupola may be varied to permit a change from acid to basic slag operation or vice versa. Special deep well spouts are available for use with the basic slag practice.

Whatever practice you intend to use, be sure to look into Whiting Cupolas—for they are built for a lifetime of efficient service.

They are easy to erect and the design permits the use of standard refractory shapes from top to bottom. Piping costs are held to a minimum because the tangential blast entrance allows the most direct connection from blower to windbox.

The location of windbox above the tuyeres allows for easy light-up arrangements. Air for melting is distributed evenly with minimum resistance—with no air leakage in windbox. Lining and stack are protected against moisture by stack joints that open downward.

A fusible safety plug is provided with a special safety tuyere. If the cupola tender does not tap quickly enough, the metal and slag flow through a channel which prevents slag from entering other tuyeres and will warn the operator. Another safety feature is a double-cone spark arrester to reduce fire hazards.

These cupola principles result in economy and high quality molten iron. It will pay you to call in a Whiting Engineer to discuss your requirements. He has the *experience* to help you plan your installation. At least 90% of the cast iron that is melted in cupolas is melted in Whiting Cupolas! Write or phone for his counsel now!

WHITING CORPORATION

15628 Lathrop Avenue, Harvey, Illinois

Send for Whiting Bulletin FY-172 entitled "Whiting Cupolas." 24-pages packed with illustrations and information about the Cupola, Tuyere Design, Cupola Accessories, Whiting Hot Blast and complete statistics. Write today!

MEMBER FEMA

modern castings *and* **American Foundryman**

CIRCLE NO. 105, PAGE 81-82